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The Northeast Yukon: Development within a Conservation Framework

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Northern Affairs Program

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Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Don Forbes

Plate 1: Aerial view of King Point, Yukon (looking southeastward)

THE NORTHEAST YUKON: DEVELOPMENT WITHIN A

CONSERVATION FRAMEWORK

ABSTRACT

The north Yukon has been the subject of conflicting land use proposals since the late 1960's. In recent years, several companies have proposed the construction of a deep draft harbour at King Point on the Yukon coast. Conservation interests have opposed development at King Point on environmental grounds, and, as part of their land claims settlement, the Inuvialuit have established an environmental screening and review process to which every proposal for development on the north Yukon slope is subject. The wilderness of the north Yukon is an international heritage and must be protected. However, a careful analysis of the likely environmental impacts in the King Point region of a proposed harbour and quarry indicates that development could proceed under stringent terms and conditions which would protect the surrounding wilderness. Designation of the northeast Yukon as a territorial wilderness park and the entire north Yukon (including the North Yukon National Park) as a Biosphere Reserve would provide the required conservation framework within which limited, carefully controlled development could proceed.

RÉSUMÉ

Depuis la fin des années 1960, le nord du Yukon a fait l'objet de propositions incompatibles d'aménagement des terres. Au cours des dernières années, plusieurs sociétés ont proposé l'aménagement d'un port profond à King Point, sur la côte du Yukon. Les groupes voués à la conservation se sont opposés au projet de King Point pour des raisons d'ordre environnemental et, dans le cadre du règlement de leurs revendications territoriales, les Inuvialuit ont créé un processus d'étude et d'examen en matière d'environnement auquel doivent se soumettre toutes les propositions de mise en valeur du versant nord du Yukon. L'état naturel du nord du Yukon est considéré comme partimoine international et doit être protégé. Cependant, d'après une analyse détaillée des répercussions environnementales probables dans la région de King Point de l'aménagement d'un port et d'une carrière, il serait possible de permettre ces travaux dans des conditions très sévères qui assureraient la protection de l'état natural des lieux. La création d'un parc naturel territorial dans le nord-est du Yukon et d'une réserve de la Biosphère couvrant tout le nord du Yukon (y compris le parc national du nord du Yukon) pourrait offrir le cadre de conservation nécessaire dans lequel une mise en valeur limitée et bien controllée pourrait avoir lieu.

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CHAPTER I

Introduction

The north Yukon is unspoiled wilderness, "a land richer in wildlife, in variety of landscape and vegetation, and in archaeological value than any other in the Canadian Arctic" (Calef, 1974; location map, figure 1). It is also an area that has been identified for a variety of non-renewable resource developments ranging from small-scale mining of unusual mineral crystals for collectors (Whitehorse Star, July 11, 1983) to large-scale quarry and harbour development at King Point (Peter Kiewit Sons Company Limited, 1983; Monenco Limited and Interlog Consultants Limited, 1985). King Point is a small, almost insignificant projection of land on the Beaufort Sea coast (plate 1 and figure 2). The latter proposals have acted as a catalyst for intense discussions on the future of the north Yukon and provide the central focus for this study.

The environmental management and development framework in north Yukon is complex. The federal Department of Indian Affairs and Northern Development (DIAND) is the "land manager" with quasi-provincial powers and regulates onshore development activities under a variety of legislation, principally the Territorial Lands Act. Virtually all land in Yukon is controlled by DIAND. The federal departments of Fisheries and Oceans and Environment have broad responsibilities in the area of environmental management (both onshore and offshore), and Transport Canada has a mandate to ensure safe navigation, including harbour operation. The Government of Yukon has responsibility for wildlife management (excluding fish, migratory birds and marine mammals) but not for habitat management (except on Commissioner's lands). In north Yukon, only Herschel Island falls under the direct administration of Yukon. The Inuvialuit have reached an agreement with the federal government and Yukon which provide them with broad ranging rights and responsibilities in north Yukon, including environmental impact screening and the Vunatut Gwitchen of Old Crow are currently negotiating for similar rights.

The north Yukon is essentially untouched by the industrial world and has only isolated pockets of human activity. It possesses exceptional attributes: millions of migratory birds, the approximately 180,000 - strong Porcupine caribou herd, a large grizzly bear population, a varied native culture, rich archaeological history and unsurpassed scenery. The north Yukon encompasses arctic, alpine and subarctic ecosystems and includes wetlands, unglaciated mountain ranges, wild rivers, vast coastal plain and an arctic coastline of bays, lagoons, long barrier islands and high tundra cliffs. Industrial development may not be compatible with these features.

The question addressed here, therefore, is: Is it possible to permit industrial development (at King Point) which could provide badly needed employment while at the same time leaving the wilderness values of the surrounding region (the north Yukon) unaffected?

This issue is examined through a series of related questions:

1) What is the background to the problem and what is the legislative framework? These questions will be addressed through a review of the north Yukon controversy to date, and a review of the existing land management framework (Part One);

2) What are the environmental risks of development at King Point? Can some development proceed? These questions will be addressed through an analysis of the environmental values of the King Point region and the likely environmental impacts associated with a quarry and multi-user harbour development (Part Two); and

3) Is there a conservation framework within which limited development could proceed? This question will be addressed through an examination and discussion of relevant conservation initiatives and the most appropriate pieces of federal and territorial legislation (Part Three).

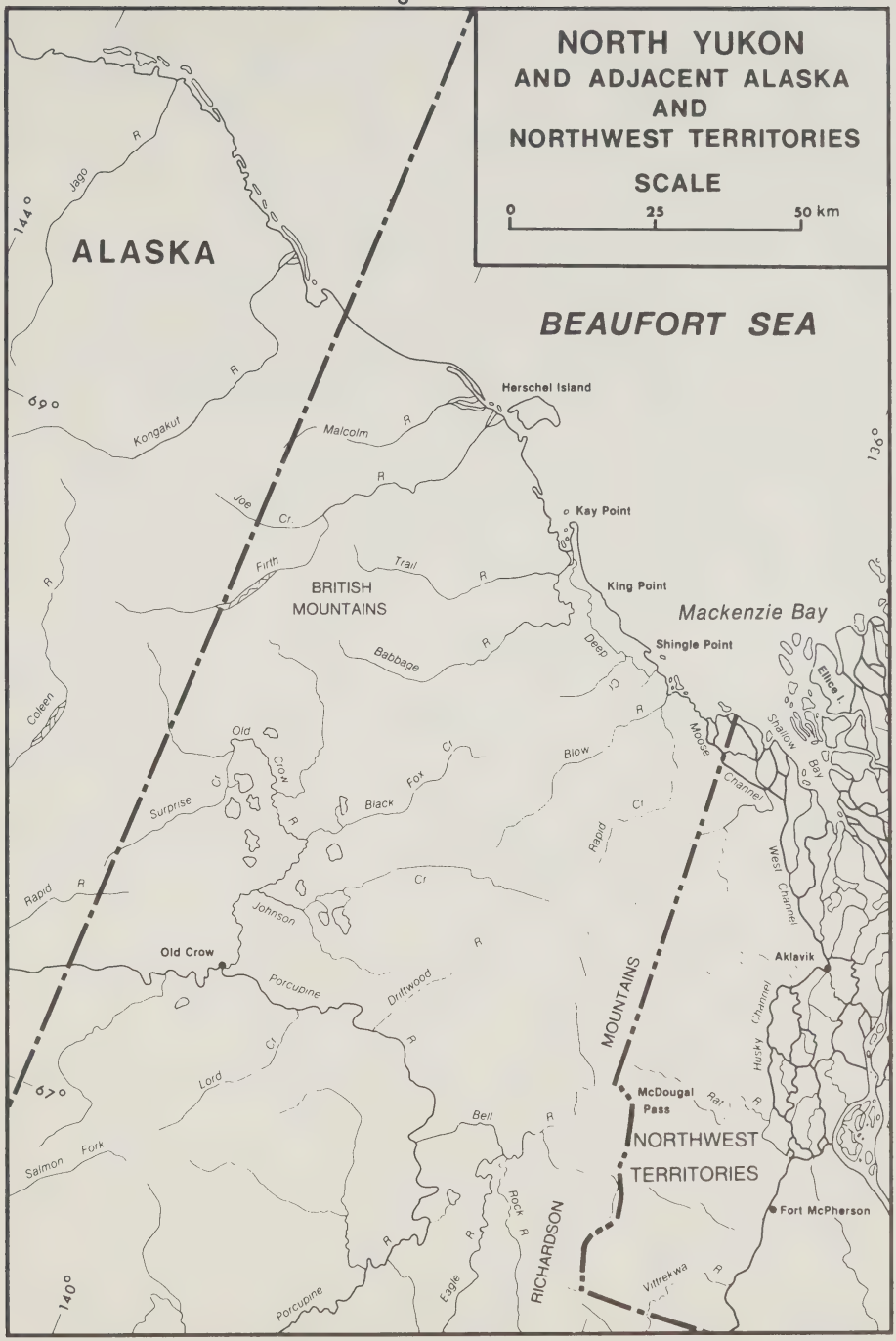

NORTH YUKON
AND ADJACENT ALASKA
AND
NORTHWEST TERRITORIES
SCALE
0
25
50 km
ALASKA
BEAUFORT SEA
Herschel Island
Kay Point
King Point
Shingle Point
Mackenzie Bay
BRITISH
MOUNTAINS
MOUNTAINS
Old Crow
Aklavik
McDougal
Pass
NORTHWEST
TERRITORIES
Fort McPherson
Jago R.
Kongakut R.
Malcolm R.
Joe Cr.
Firth R.
Trail R.
Babbage R.
Deep Cr.
Coleen R.
Old Crow R.
Surprise Cr.
Black R.
Fox Cr.
Blow R.
Rapid Cr.
Rapid R.
Johnson R.
Porcupine R.
Driftwood R.
Lord Cr.
Salmon Fork
Bell R.
Rat R.
Rock R.
Eagle R.
Porcupine R.
Vittrekwa R.
Moose Channel
Shallow Bay
West Channel
Husky Channel
Ellice I.
RICHARDSON
140°
67°
136°
69°
144°

Figure 1

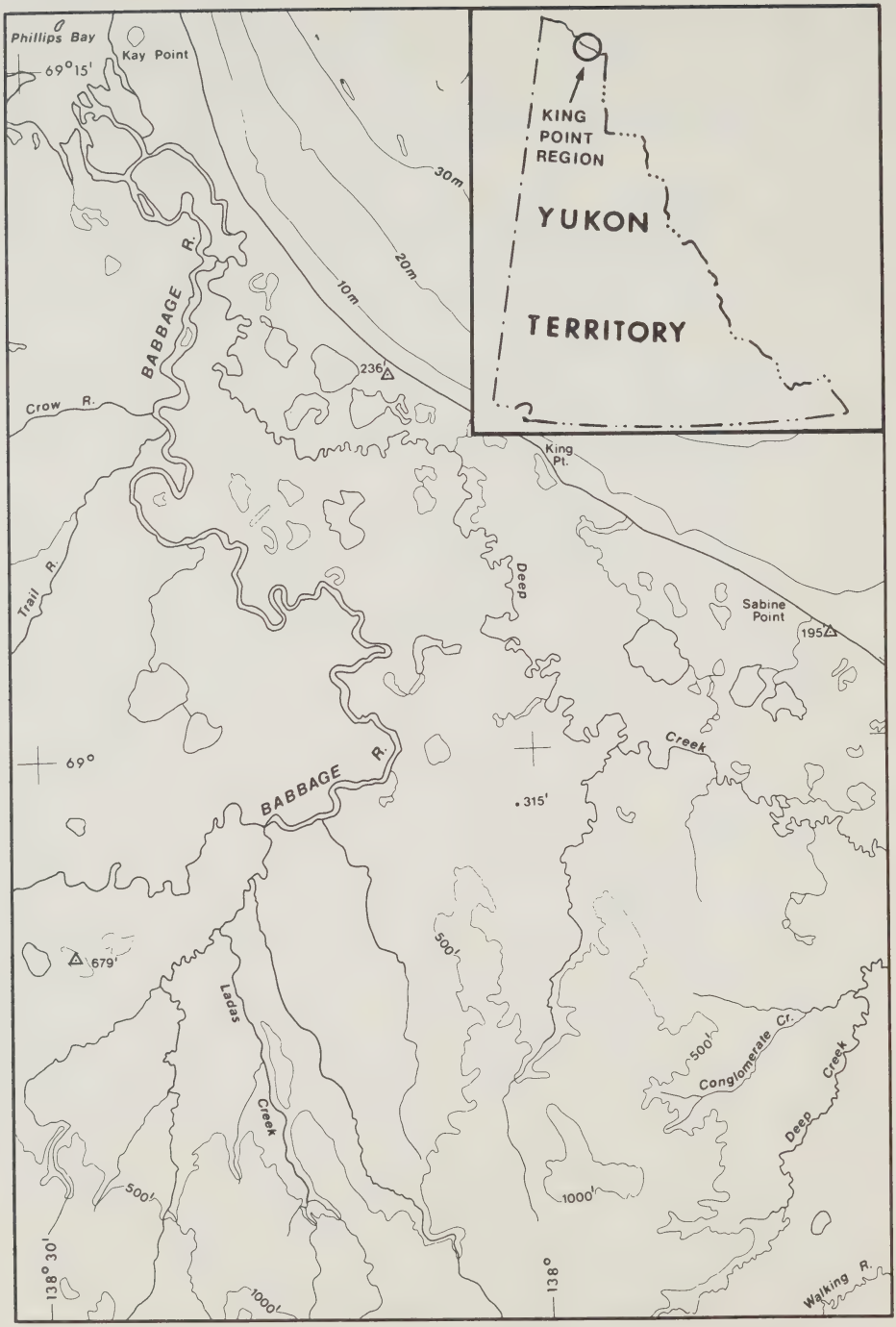


Figure 2 King Point Region, Yukon Territory

PART A

Background, Perspectives and the Land Management Framework for Development in the North Yukon

CHAPTER II

Background

Over the past 15 years, a number of conflicting proposals for the north Yukon have been put forward by a variety of interest groups ranging from oil companies through government to conservation organizations. Several proposals have been made for industrial development at or near King Point. At least as many proposals have been made to set aside in perpetuity the entire north Yukon as wilderness or to permit limited, small scale development under very strict conditions - conditions intended to ensure that the wilderness values are protected. In 1983, Peter Kiewit Sons Company Ltd. (Kiewit) of Toronto proposed the construction and operation of a quarry and harbour facility at King Point to supply rock for artificial islands required by the oil and gas industry for exploration and production (Peter Kiewit Sons Company Ltd., 1983). In 1985, Monenco Limited and Interlog Consultants Ltd. submitted an application to the Department of Indian Affairs and Northern Development to build and operate a multi-user, deep draft harbour at King Point.

The north Yukon, normally defined as the area north of the Porcupine and Bell rivers (figure 1), has been the object of a number of conservation-oriented proposals since 1970. In 1978, as a result of pressure from the Inuvialuit, who were negotiating their land claim to the area, and pressure from conservation groups, the entire north Yukon was temporarily withdrawn from future disposition under Order in Council (figure 3).

Included in the conservation-oriented proposals (detailed in Appendix 1) are a proposal by Thompson (1970) to designate the north Yukon as part of an international wildlife range (figure 4), a proposal by Mr. Justice Berger (1977) to establish a wilderness national park in the north Yukon (figure 5) and similar recommendations by Parks Canada (1978; figure 6), the Canadian Wildlife Service (1979; figure 7) and the Department of the Environment (1979; figure 8). The Inuvialuit Land Rights Settlement Agreement in Principle (1978) included provision for a north Yukon national park (figure 9). The Inuvialuit Final Agreement (1984) established a national park (figure 10), a territorial park on Herschel Island and an environmental screening and review process for the north Yukon outside the national and territorial parks. The area outside the parks remains under the withdrawal order.

At the same time, a number of siting studies have been carried out by government and industry to determine the most favourable location in the Beaufort Sea for moderate to deep draft harbour development, when and if such a facility is required to support hydrocarbon development. The advantages offered by the Yukon coast between Kay Point and Shingle Point (the "Babbage Bight"), and specifically King Point, have been identified in various studies (Public Works Canada, 1971; Advisory Committee on Northern Development, 1977; Dome, 1979; Gulf Canada, 1982; Indian and Northern Affairs Canada, 1983b; Peter Kiewit Sons Company Limited, 1983; and Indian and Northern Affairs Canada, 1983d).

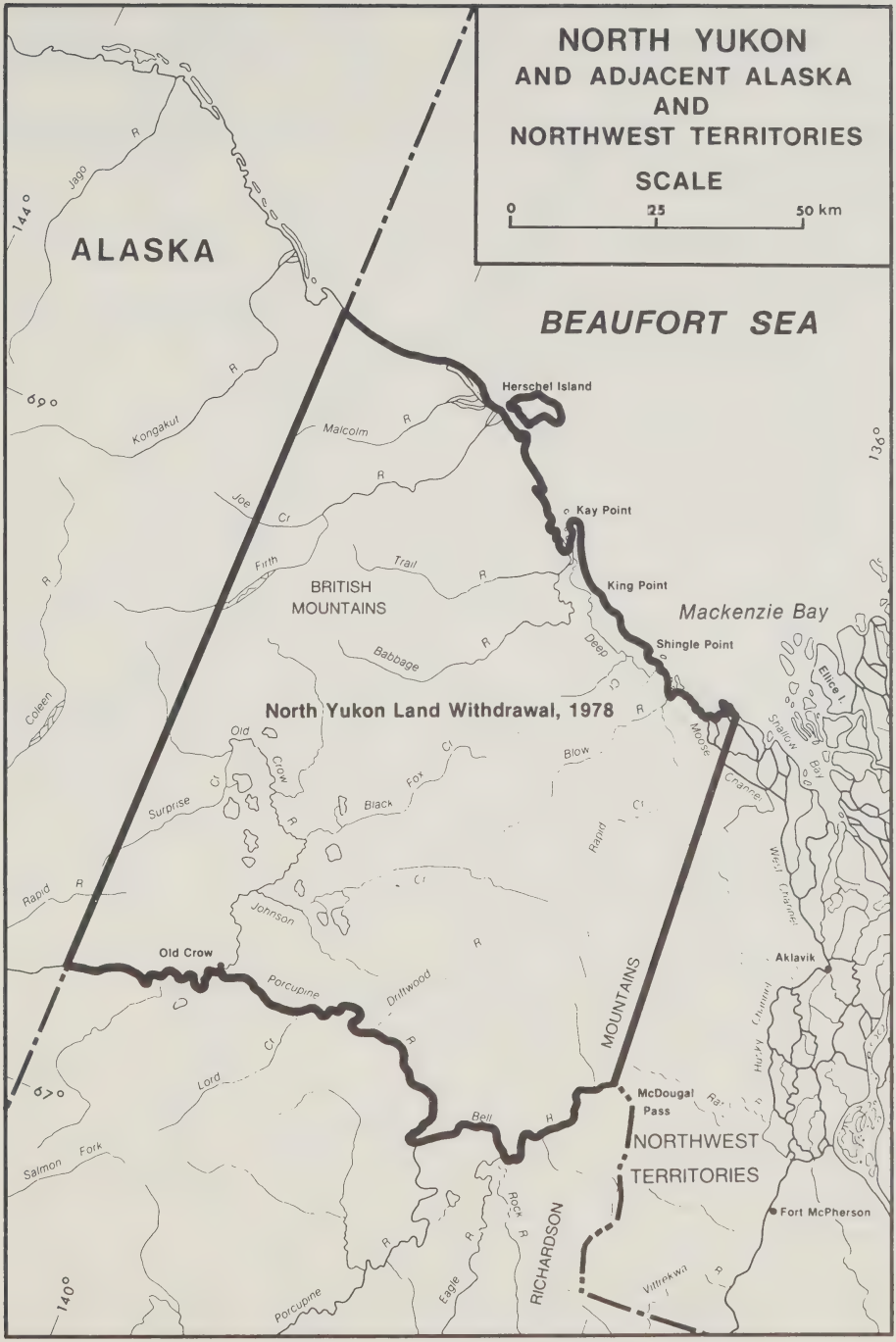


Figure 3 North Yukon Land Withdrawal, 1978
(withdrawn under the Territorial Lands Act through Order in Council)

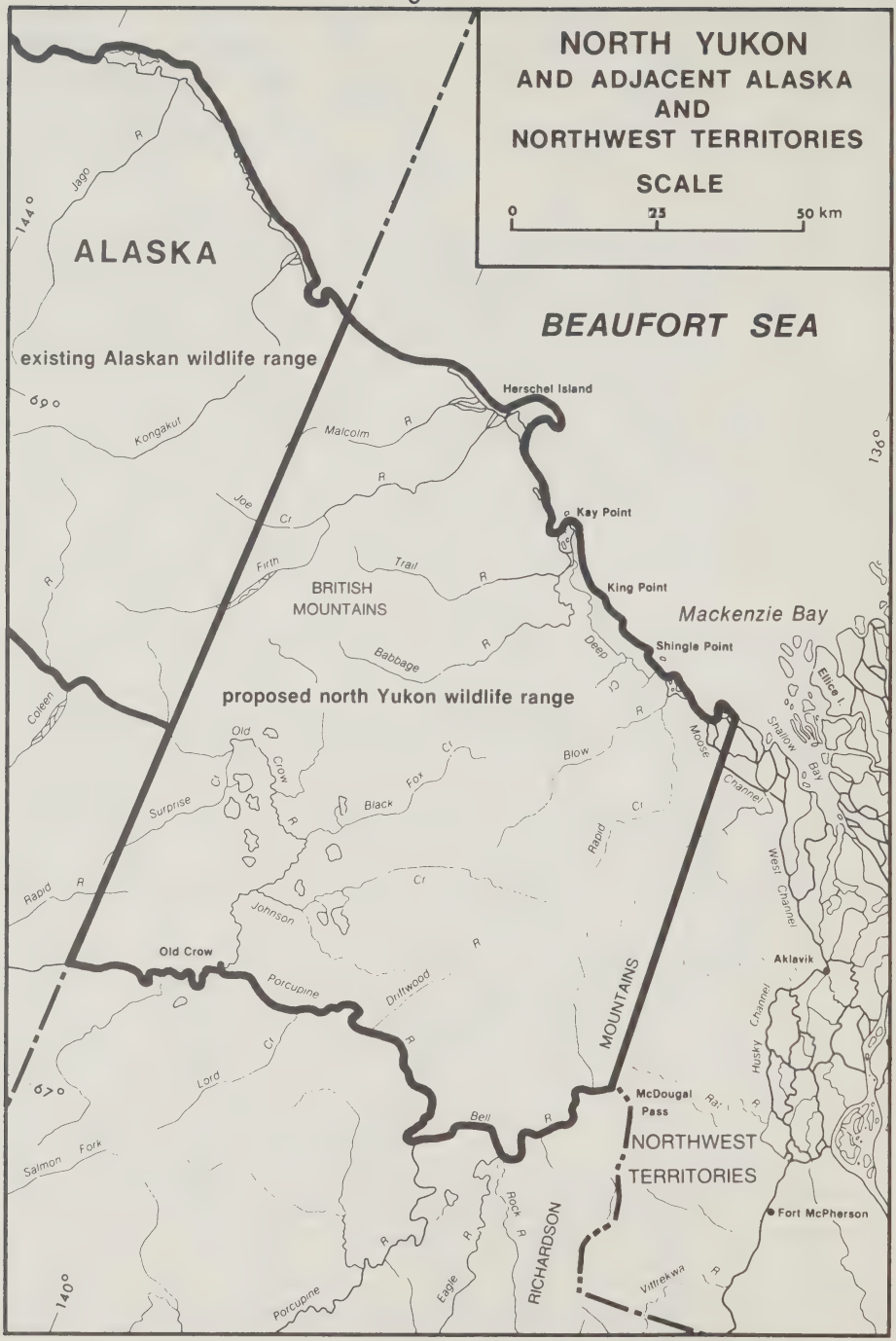


Figure 4 Arctic International Wildlife Range Conference Proposal for an Arctic International Wildlife Range (1970)

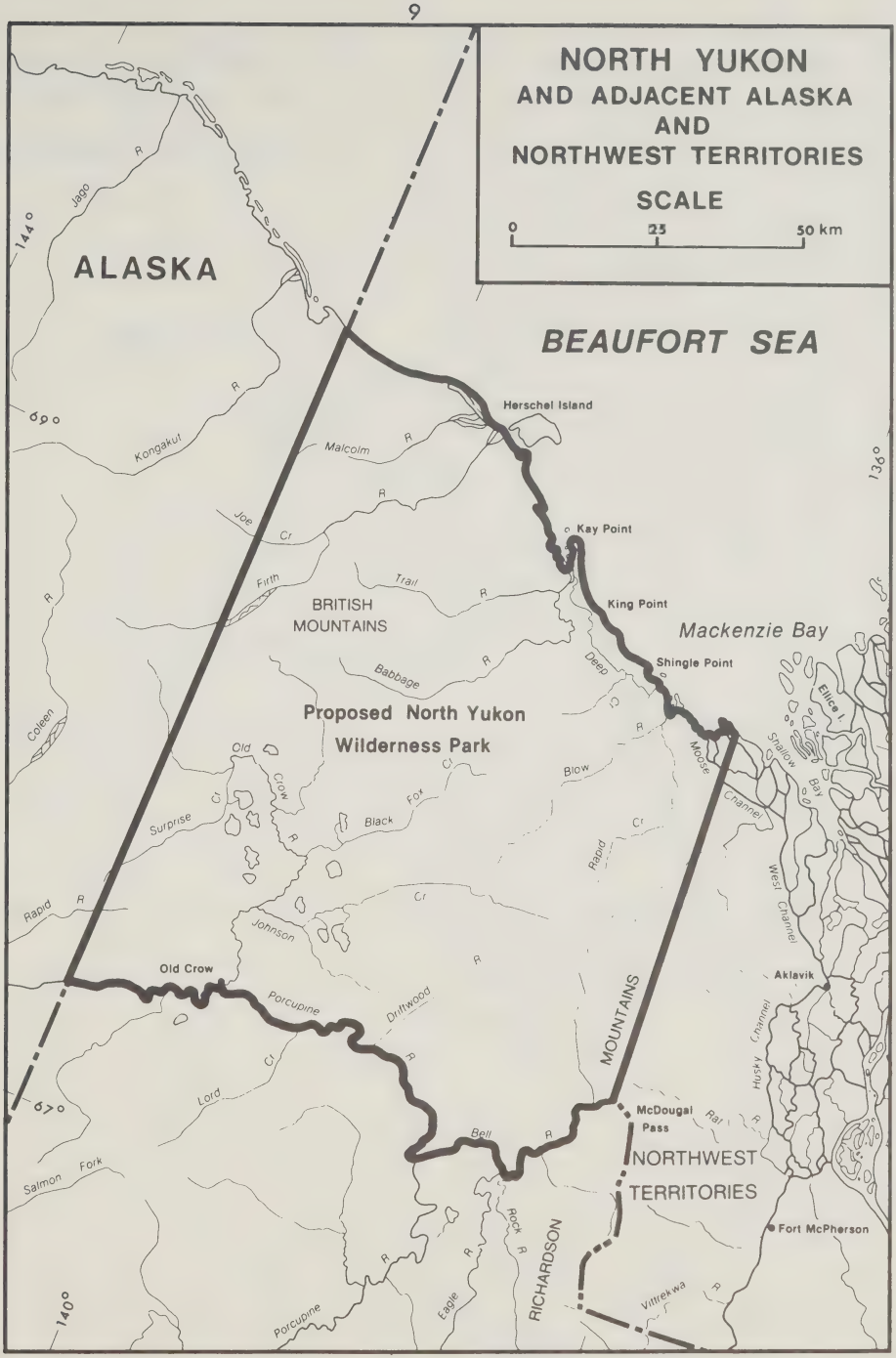


Figure 5 North Yukon Wilderness Park
Proposed by Justice Berger (1977)

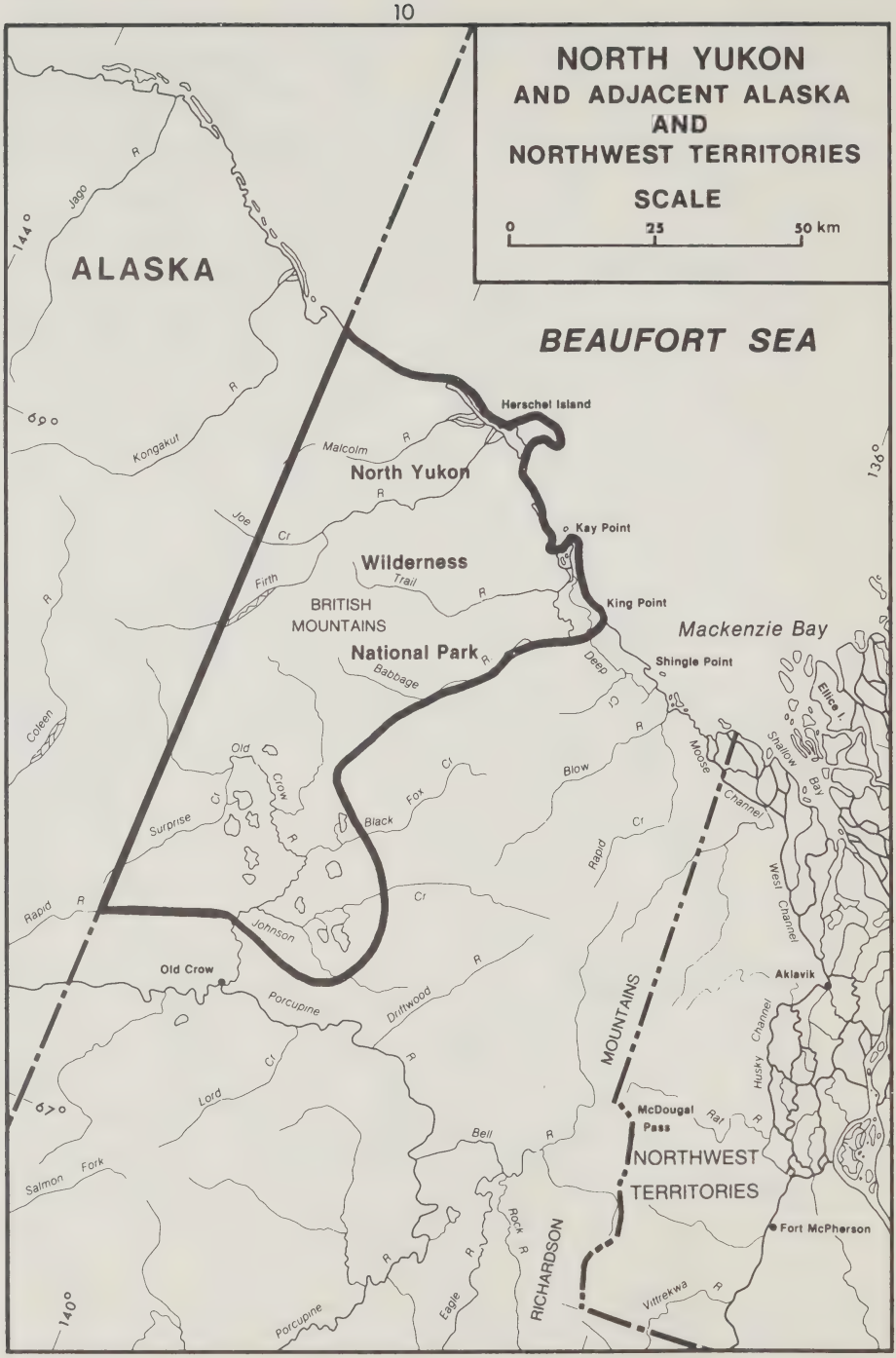


Figure 6

Parks Canada Proposal for a North Yukon Wilderness National Park (1978)

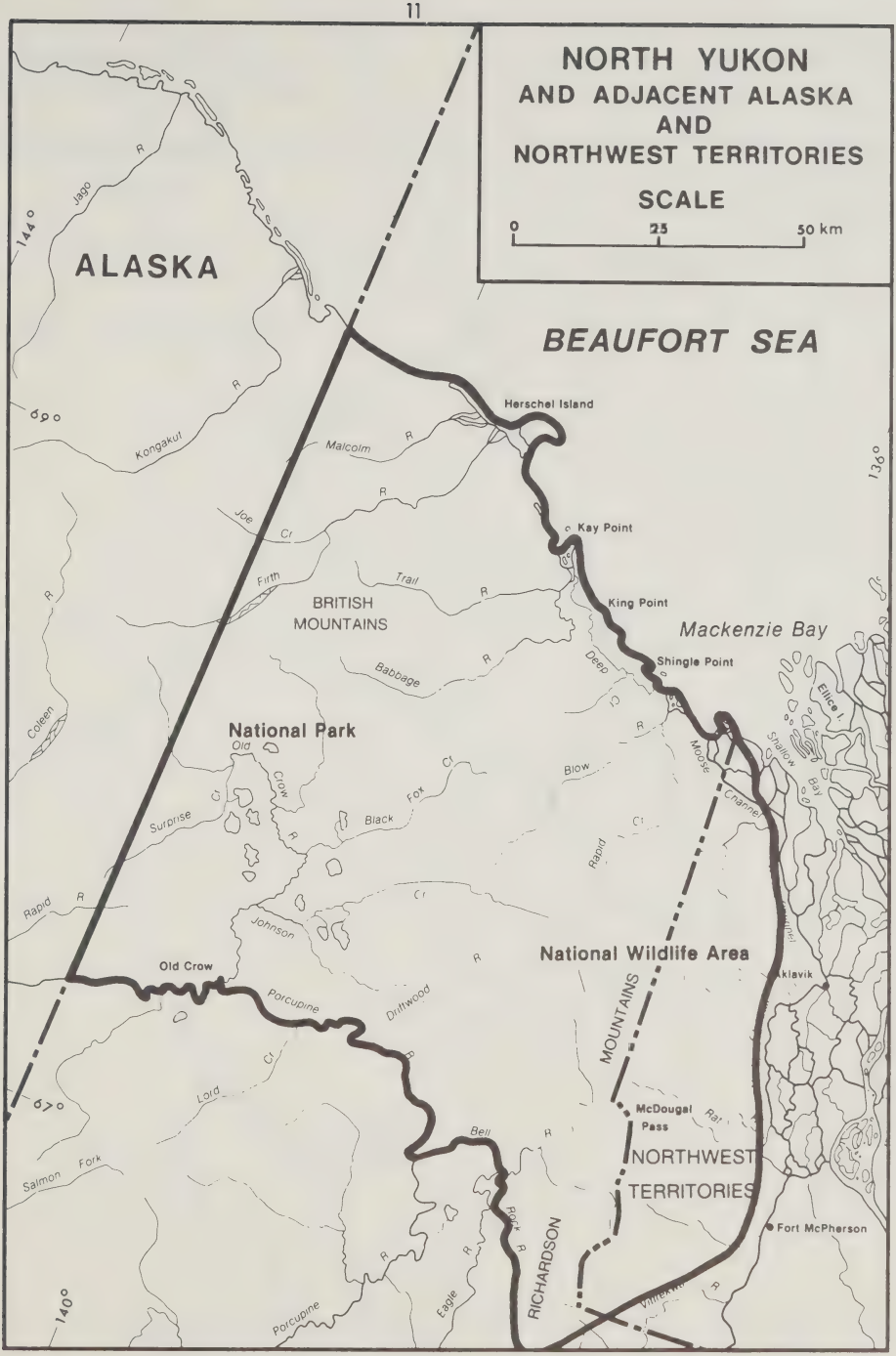


Figure 7 Canadian Wildlife Service Proposal for a Combined North Yukon National Park and National Wildlife Area (1979)

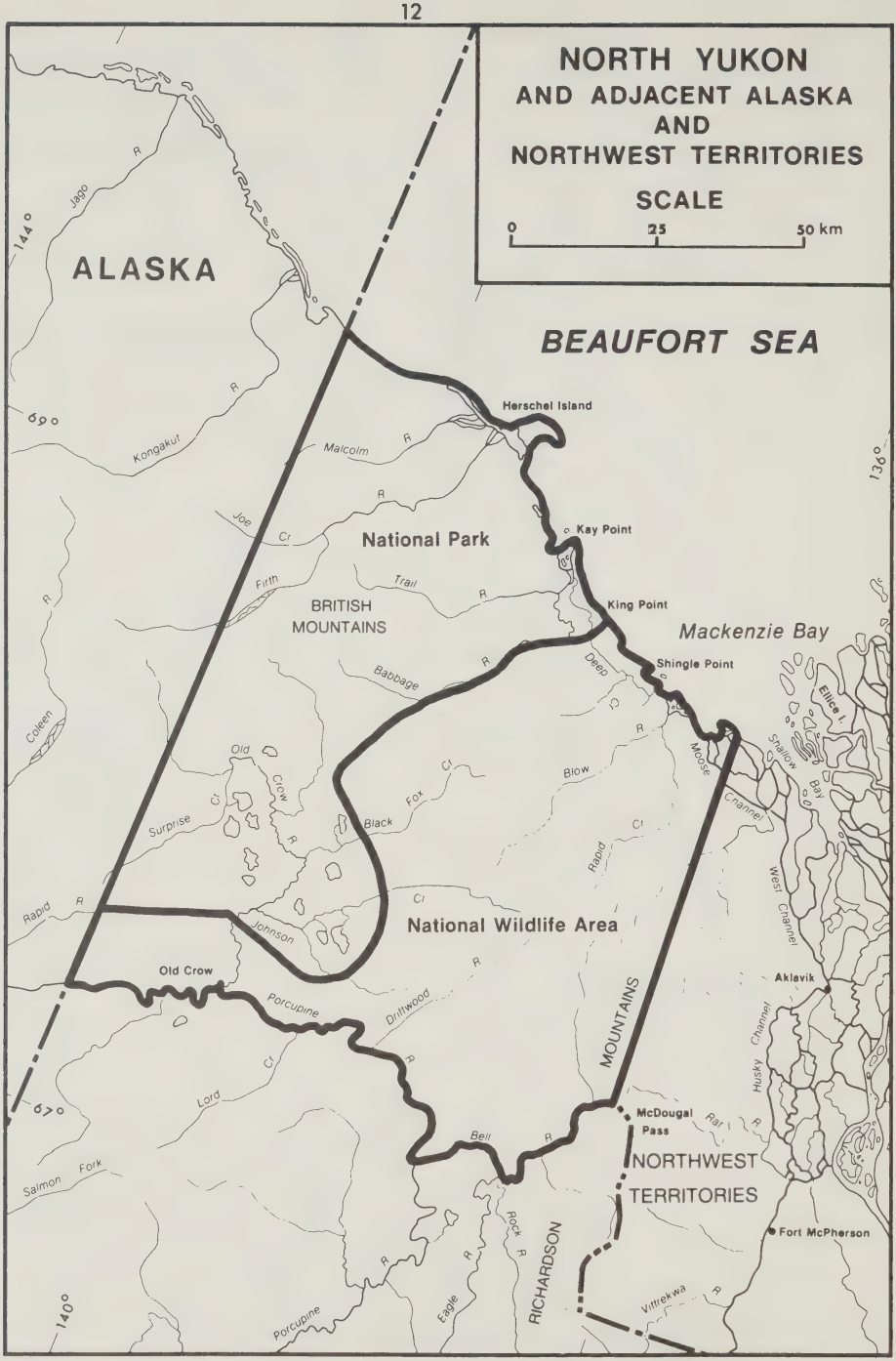


Figure 8 Environment Canada Proposal For a North Yukon Wilderness National Park and a National Wildlife Area (1979)

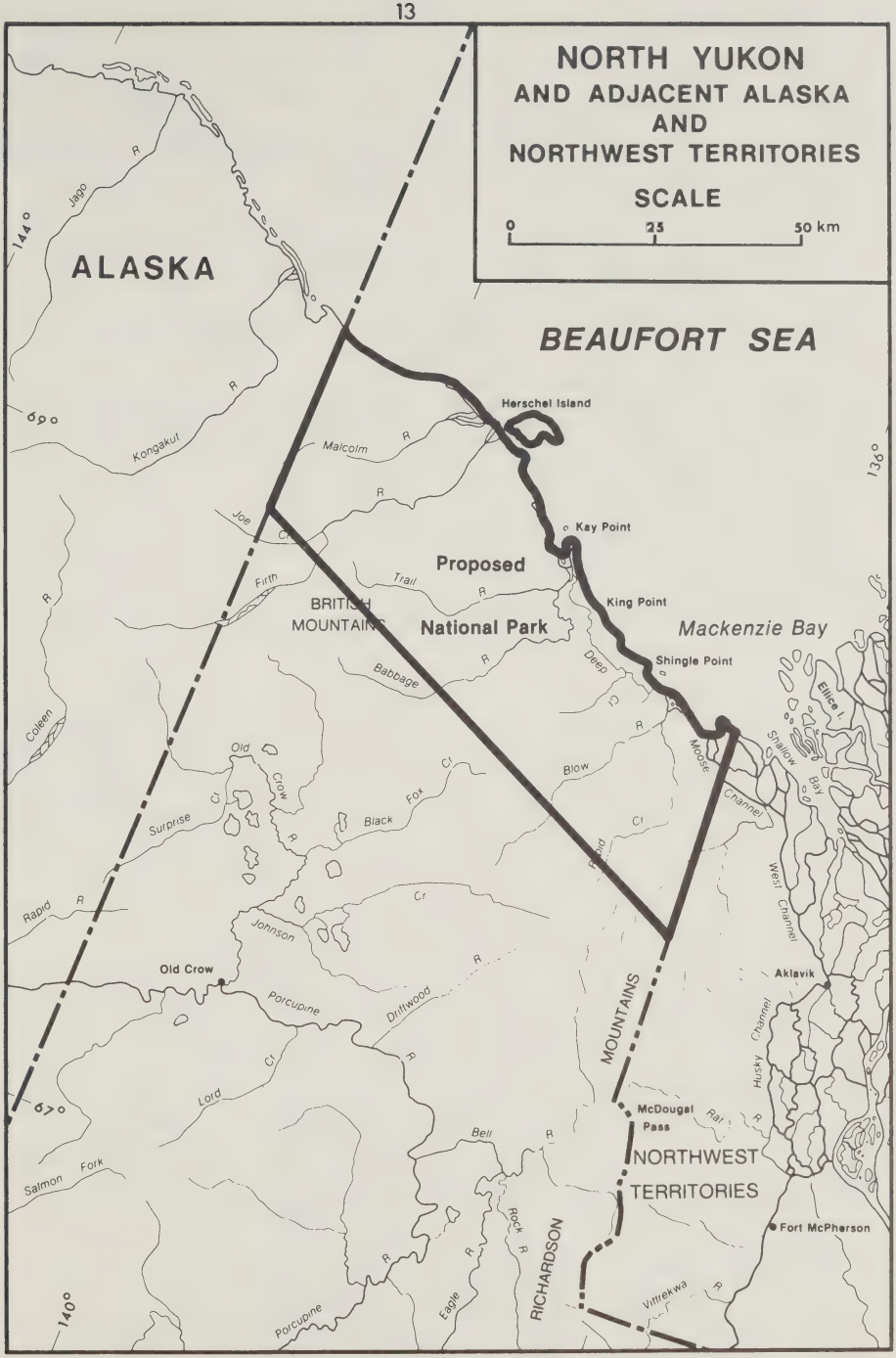


Figure 9 Proposed National Park under the Canada – Inuvialuit Agreement in Principle (1978)

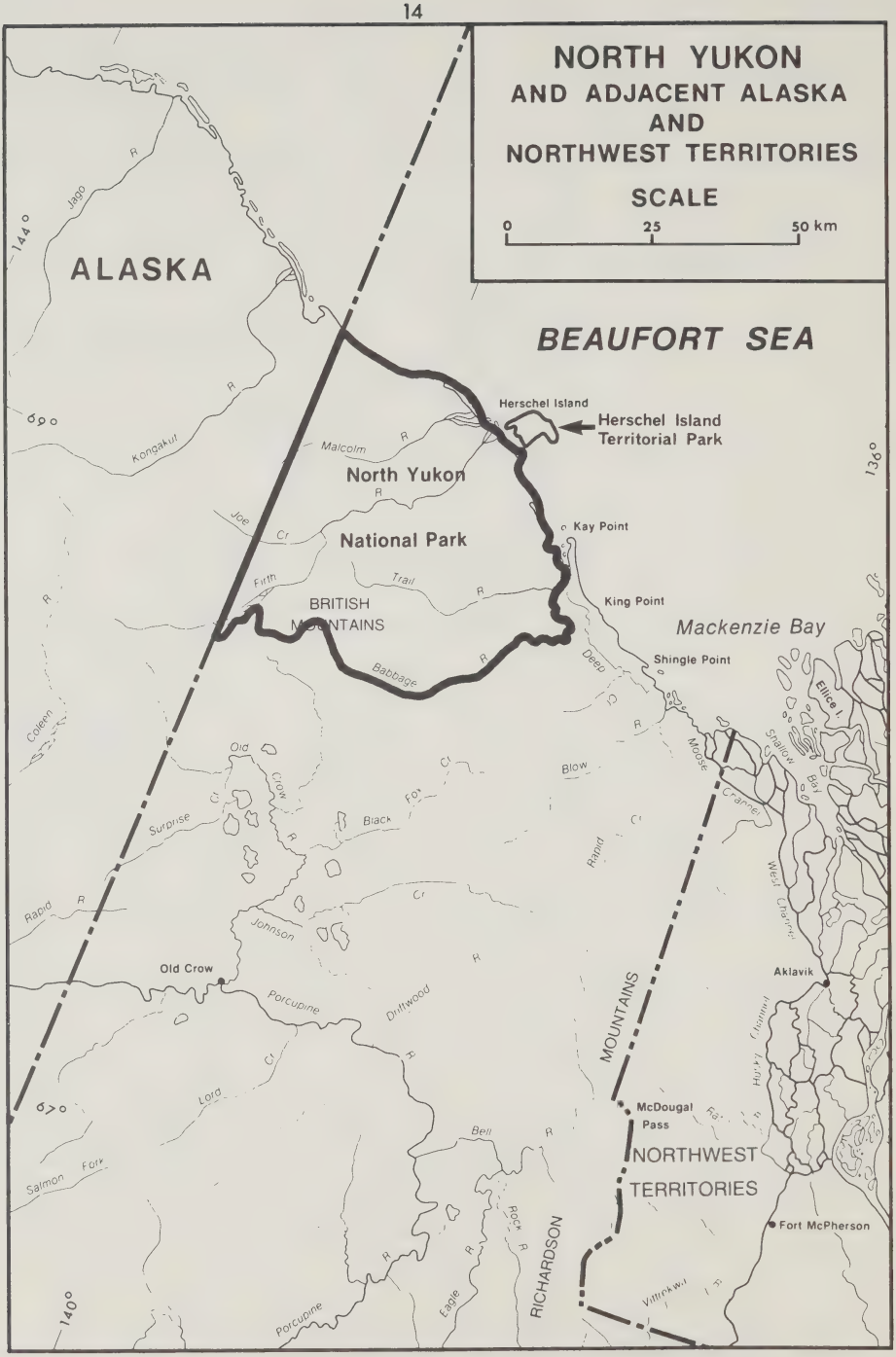


Figure 10 North Yukon National Park (established 1984)

A number of companies have prepared somewhat detailed proposals for the construction and operation of a harbour and shorebase at King Point. Dome Petroleum Limited prepared a profile in 1979 (figure 11) and updated it in 1982 (figure 12) as part of the "Environmental Impact Statement for Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region" (Dome et al., 1982a). As noted earlier, Kiewit and a Monenco-Interlog consortium also submitted proposals for development at King Point (figures 13 and 14, respectively). These proposals are outlined in detail in Appendix 1. Figure 15 shows the area required by shorebases in Alaska and the Shetland Islands, overlain on a map of the King Point area.

As noted earlier, the north Yukon outside the national and territorial parks remains withdrawn under Order in Council from disposition for any purpose. Any proposal for development on the North Slope (that area of the north Yukon between the coast and the height of land to the south) must be screened for environmental and socio-economic impacts under the environmental screening and review provisions of the Inuvialuit Final Agreement (detailed in Chapter IV). If approved, the project must then comply with various federal and territorial environmental regulations before it can proceed. Any development will also have to meet economic and social terms and conditions set out by the Inuvialuit and the Council for Yukon Indians (CYI), as stipulated in the Inuvialuit Final Agreement and the CYI Agreement in Principle.

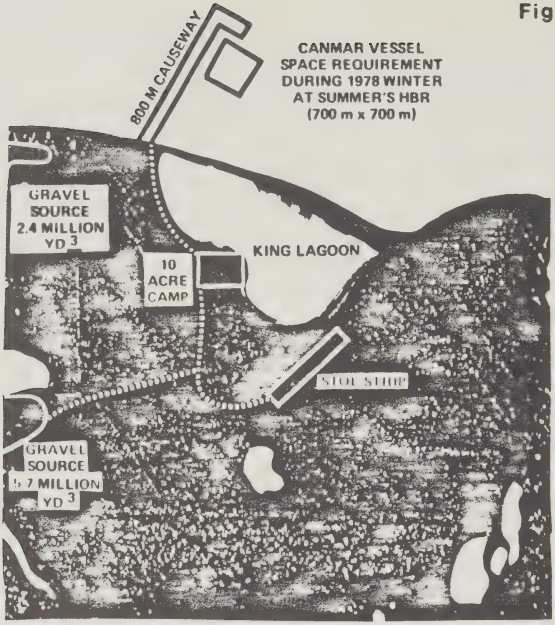
As a result, the Minister of Indian Affairs and Northern Development no longer has the kind of exclusive decision-making authority over the future of the north Yukon that was the case less than 15 years ago. The Government of Yukon is increasingly more influential, indeed can be considered to have de facto veto powers. Moreover, public and private interest groups are also more vocal and influential. All these interests must be taken into consideration when decisions affecting the north Yukon are made. As a result, these decisions can be difficult and complex.

There is currently no industrial development on the Yukon coast. There are two active and one abandoned DEW line sites and a small collection of abandoned historical buildings at Pauline Cove on Herschel Island. Gulf Canada has a small radio transmitting station at Stokes Point, and several exploratory wells (dry, plugged and abandoned) have been drilled onshore. Apart from these intrusions, the region remains wilderness.

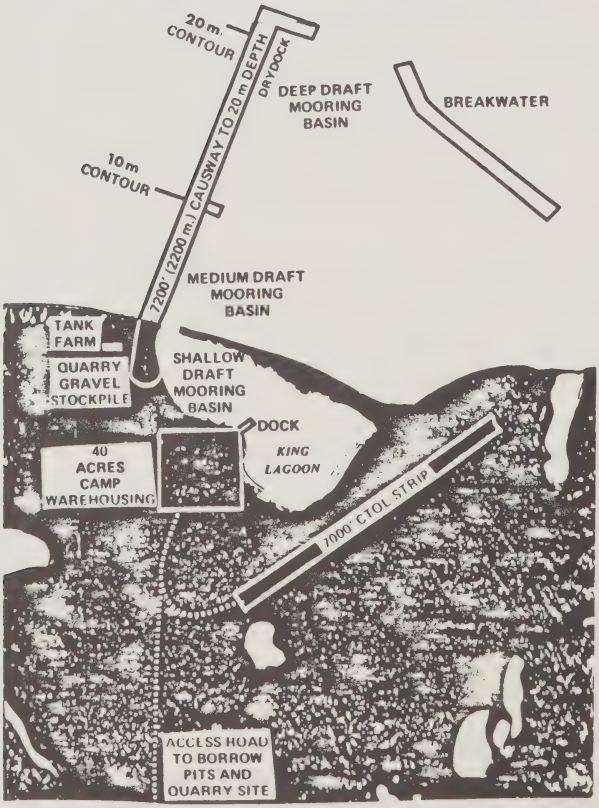
The need for a deep draft harbour at King Point to support offshore oil and gas production will be determined within the next few years. In the meantime, barge traffic down the Mackenzie River, truck transport along the Dempster Highway and the occasional shallow or medium draft ship from the south will continue to meet industry's resupply needs. Nevertheless, both industry and government foresee that a deep draft harbour in the Canadian Beaufort may be required in the future and they continue to plan for that possibility. The various perspectives of industry, governments, private citizens and public interest groups on this kind of development are outlined in the next chapter.

Figure 11 Dome Petroleum Ltd. Proposal for Short Term and Long Term Development at King Point, Yukon

(from Dome Petroleum Ltd., 1979)



(a) Short Term Use



(b) Long Term Use

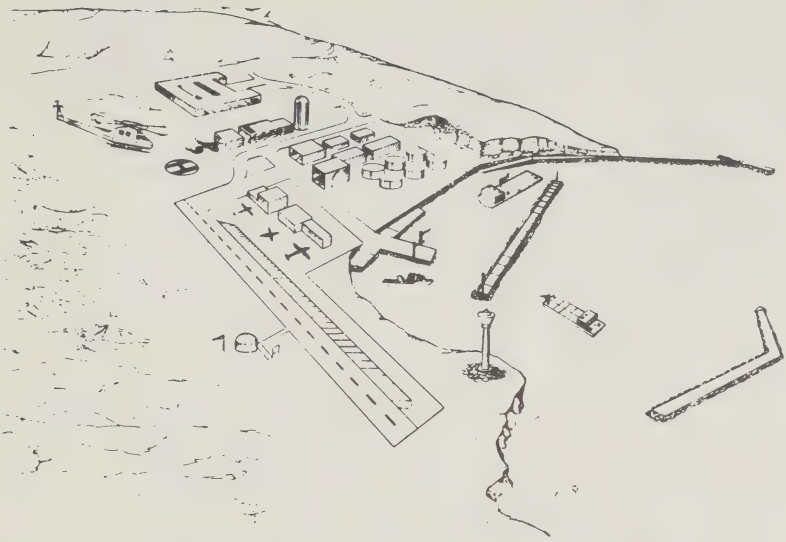
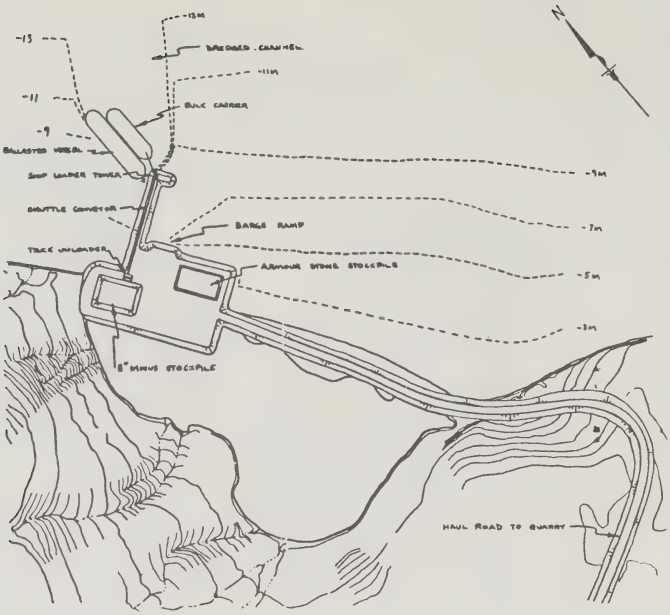
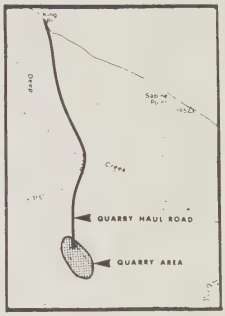
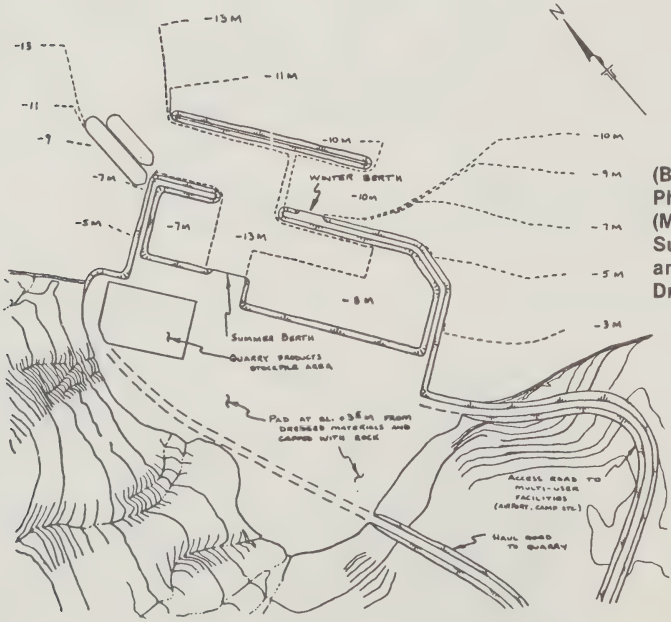


Figure 12 Dome Petroleum, Esso Resources and Gulf Canada Proposal for Harbour Development at King Point, Yukon (from Dome et al, 1982)



(A)
Phase 1
(Single-User;Rock Berm and Dredged Channel for Bulk Carrier Loading and Pad for Temporary Storage of Quarry Products)





(B)
Phase 2
(Multi-User; Protective Berms, Summer and Winter Berths and Offshore Breakwater. Additional Dredging and Related Pad Construct

Figure 13 Peter Kiewit Sons Company Limited Proposal for Quarry and Harbour Development at King Point, Yukon

(from Kiewit, 1983)

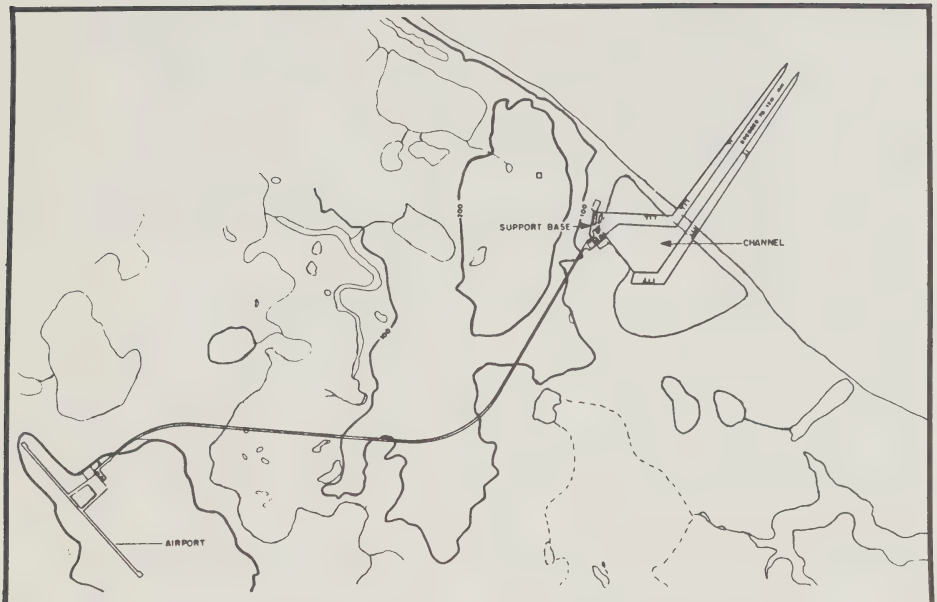


Figure 14 Monenco/Interlog Harbour Proposal for King Point, Yukon (from Monenco Ltd. and Interlog Consultants Ltd., 1985)

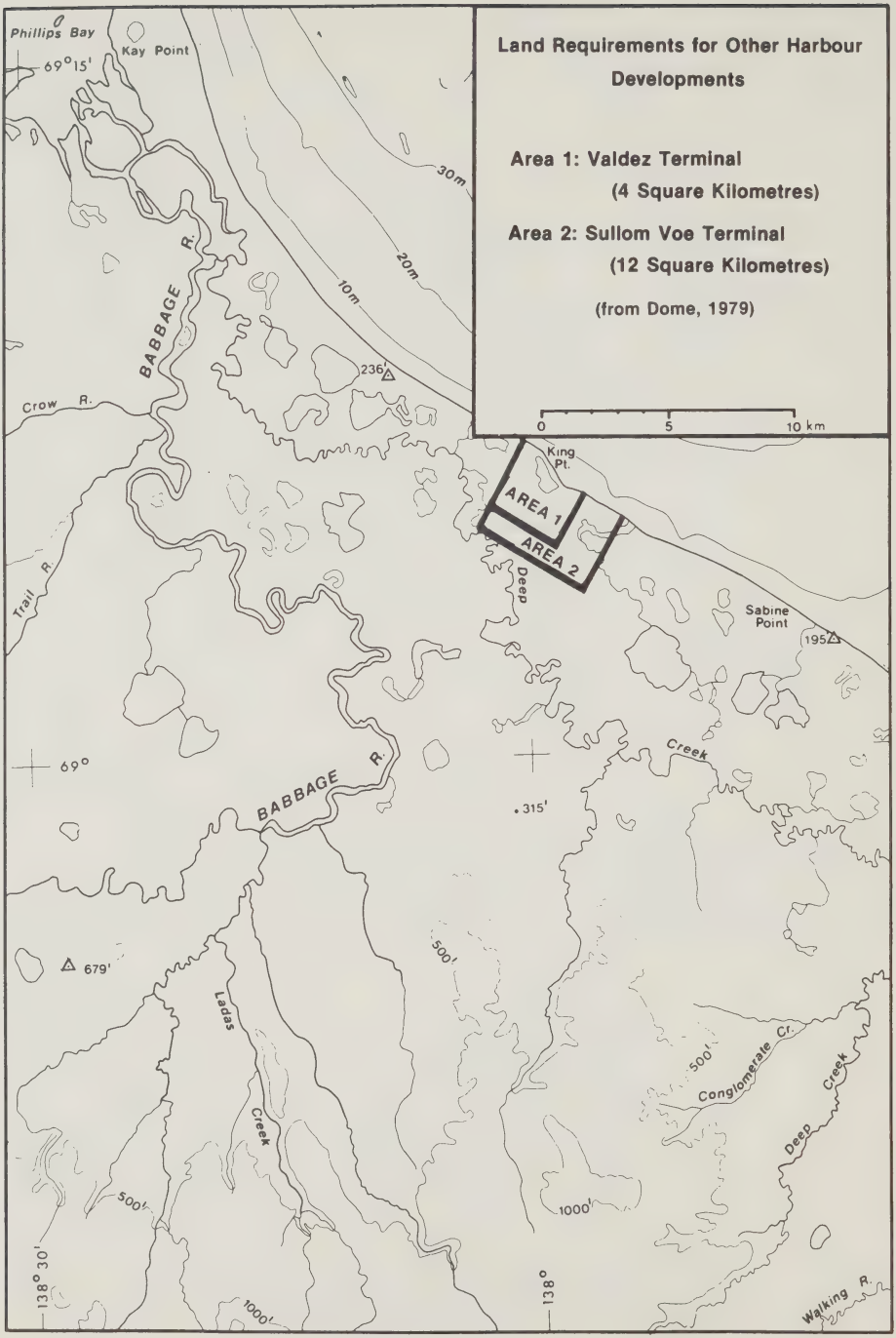

Land Requirements for Other Harbour Developments
Area 1: Valdez Terminal
(4 Square Kilometres)
Area 2: Sullom Voe Terminal
(12 Square Kilometres)
(from Dome, 1979)
0
5
10 km
Phillips Bay
Kay Point
69°15'
30m
20m
10m
BABBAGE R.
236'
Crow R.
King Pt.
AREA 1
AREA 2
Deep
Trail R.
Sabine Point
195'
69°
BABBAGE R.
315'
Creek
679'
500'
Ladas
Creek
Conglomerate Cr.
Deep Creek
1000'
138° 30'
138°
Walking R.

Figure 15

CHAPTER III

Perspectives on the Need for a Harbour and Quarry Development at King Point

1. The Yukon Perspective

Unemployment is high in Yukon, and a combined harbour and quarry operation at King Point could offer several hundred jobs (Kiewit, 1982; Dome et al., 1982a). The Yukon government is understandably anxious to provide long term employment opportunities, and both the Council for Yukon Indians (CYI) and the Inuvialuit reached agreement with Kiewit on business opportunities in the event that the Kiewit proposal received approval. The former Conservative government of Yukon also reached agreement with Kiewit on business opportunities and social concerns related to the proposed development.

Under the previous Conservative regime, the Yukon Territorial Government (YTG) made clear its support for both temporary and permanent harbour facilities on the Yukon coast. The YTG supported the selection of King Point as the location for the only permanent harbour facility on the Yukon coast and recommended that the facility be shared by all users in the area and that the Kiewit proposal be approved by the federal government (Government of Yukon, 1983a). However, the YTG also noted that a comprehensive resource management plan for the region should be completed before approval of proposals other than Kiewit's.

The current New Democratic government of Yukon has not made an explicit statement regarding development at King Point, but it is reasonable to assume that development would be supported provided it received the approval of the native groups and met strict environmental and socio-economic terms and conditions.

On the broader issue of management and decision-making authority in Yukon, most Yukoners feel that continued federal ownership of Yukon land is inconsistent with constitutional development and are anxious to gain control of significant parcels of land. Similarly, Yukoners want to move toward full management of their renewable resources - wildlife, lands, waters, and forests. For these and other reasons, the issue of who owns the land in the northeast Yukon and who manages the resources is an important one. Continued control of the Yukon by the Department of Indian Affairs and Northern Development (DIAND) and other federal agencies is unacceptable to Yukoners. The federal government agrees in principle with this position and is moving toward increased responsibilities for YTG.

In the land claims forum, the Council for Yukon Indians has been negotiating a comprehensive land claims agreement with the federal government for a number of years. Although the settlement area does not include King Point, it does include the north Yukon south of the Beaufort Sea - Porcupine River watershed. CYI has also reached an agreement with

the Inuvialuit, whose settlement area does include the entire North Slope. This agreement provides CYI with a voice in decisions regarding development on the North Slope. The CYI Agreement in Principle (Government of Canada et al., 1984) and the Inuvialuit Final Agreement (Indian and Northern Affairs Canada, 1984a) are discussed in more detail in Chapter IV.

2. Federal Perspectives

The Department of Indian Affairs and Northern Development (DIAND) is currently the land manager in the north Yukon and plays the key role in deciding the future of the area. DIAND supported the Kiewit proposal, subject to a number of conditions including settlement of land claims, implementation of land use planning in Yukon, agreement on the establishment of a Porcupine Caribou Management Board and appropriate socio-economic agreements (Indian and Northern Affairs Canada, 1983a; 1983b; 1984b). A 1983 DIAND press release noted that land use planning for the North Slope would incorporate an area for one port and an energy/transportation corridor (Indian and Northern Affairs Canada, 1983e) and the DIAND presentation to the North Slope Project Review Group was very clear on DIAND's position regarding development at King Point:

> "In addition to the elements of the Minister's proposed package for the North Slope which deal with parks and other conservation measures, we are seeking to implement his stated objective of concentrating needed industrial development to a minimum of sites, and especially, confining any needed port development to one Yukon site. With respect to that site in the years ahead, we will want to ensure that whatever happens with the Kiewit and Gulf proposals, the department's options are maintained, so that the site can be available to other users, as appropriate. And finally, we will want to ensure that subsequent development, if it is needed, happens in a fully planned way, guided by land use planning and taking due account of the recommendations of the Beaufort EARP as they relate to the proposals by the oil companies to develop a production support base."
>
> "If we look to the future, a site on the Yukon North Slope has a significant set of advantages, not the least of which is enhancing the economic future of the Yukon, a goal shared with the Government of the Yukon. If tied in with a quarry, it opens the chance for Canadians to earn potentially hundreds of millions of dollars in the foreign trade market, and to have available, if needed, a technique for building hydrocarbon production facilities with a very high Canadian content. If properly located, such a port opens the door to valuable business opportunities for all Canadians and especially Northerners, for marine support activities aimed at the American Beaufort. And, if properly sited, it will of course have a substantial similar role if and when hydrocarbon development takes place in the Canadian Beaufort. While there are intensive reviews on this issue yet to be

> completed, nothing revealed to date suggests that King Point is not such a site."
>
> (Indian and Northern Affairs Canada, 1983d)

The interdepartmental Regional Environmental Review Committee (RERC) in Yukon (chaired by DIAND) indicated that it did not feel that the environmental implications of the Kiewit proposal warranted broad scale public review (e.g., by the Federal Environmental Assessment Review Office), although it asked Kiewit to provide further environmental detail in several areas (Bob Freisen, Chairman, RERC, personal communication). In RERC's view, the normal regulatory process was sufficient to ensure that the environmental impacts of the Kiewit proposal would be reduced to acceptable levels through the attachment of strict terms and conditions to land use permits, leases and licences. It is not clear whether this position would hold for a larger project such as that outlined in Chapter VI, which could include an all-weather road linking King Point with the Dempster Highway.

The Department of Environment (DOE) and the Department of Fisheries and Oceans (DFO) are represented on RERC and supported the position of RERC regarding the Kiewit application (i.e., tacit approval in principle). Nevertheless, DOE expressed concern that development at King Point could proceed in advance of more comprehensive planning for north Yukon, including the designation of conservation areas adjacent to the North Yukon National Park (Indian and Northern Affairs Canada, 1983d). DFO emphasized the need for a land use planning exercise to ensure that all north Yukon harbour developments are located at a single shared site in a manner designed to minimize environmental and social impacts (Indian and Northern Affairs Canada, 1983d).

3. The Perspectives of Non-Government Conservation Organizations

A number of non-government conservation organizations have also expressed their views on the development of King Point. The Canadian Arctic Resources Committee (CARC) expressed the view that a comprehensive site selection study within the context of land use planning must be done before any harbour development on the Yukon coast is approved and that this study should take into full account the proven conservation values of the north Yukon. CARC has argued that conservation is the primary goal for the north Yukon and that the onus is on developers to show clearly and precisely that their projects would not compromise conservation aims. In CARC's view, the need for development at King Point is not proven (Indian and Northern Affairs Canada, 1983d).

The Yukon Conservation Society (YCS) has taken the view that until there is a demonstrated need for a harbour on the North Slope - a need which does not exist now - development approvals are not warranted and would seriously compromise the well known conservation values of north Yukon. According to YCS a full public assessment of the need for shore based facilities and their location, size and type must be undertaken prior to approval of any harbour development on the North Slope. YCS stated that the assessment must be made within the context of a comprehensive

conservation regime for the north Yukon (Beaufort Sea Alliance, 1983; Yukon Conservation Society, 1983).

The Arctic International Wildlife Range Society also emphasized the wilderness values of the north Yukon over possible non-renewable resource based developments and recommended that no development should proceed on the North Slope until conservation planning has been completed (Beaufort Sea Alliance, 1983).

4. Perspective of the Beaufort Environmental Assessment Review Panel

In July 1984, the Beaufort Environmental Assessment Review Panel released its report on hydrocarbon production and transportation proposals for the Beaufort Sea - MacKenzie Delta region. In reference to harbour facilities on the Yukon coast, the panel recommended:

- that only one deep-draft port be permitted on the Beaufort Sea coast unless offshore production areas are so far apart that two separate deep-draft ports become necessary; and,
- that each deep-draft port proposal be subject to a formal public review process, preferably the regional land use planning process. (Beaufort Sea Environmental Assessment Review Panel, 1984).

In the panel's opinion, a deep-draft harbour can be constructed in the Babbage Bight area without significant adverse environmental impacts. However, the panel felt that the potential adverse impacts on the Porcupine caribou herd, snow geese, fish and marine mammals, national park interests and the likelihood that environmental impacts would be lower east of Kay Point dictate that no port or supply base should be built west of Kay Point. In order to minimize adverse impacts, the panel recommended that only one deep-draft port be permitted on the Yukon coast, that it be developed as a multi-use facility and that shallower-draft port and supply bases be restricted to existing sites. The panel also recommended that there should be no construction of a King Point - Dempster Highway road link unless access, particularly by hunters, could be strictly controlled.

5. The Commercial Viability of Existing Proposals

Kiewit was unable to establish firm markets for quarry material in either the U.S. or Canadian portions of the Beaufort Sea; the commercial viability of that proposal is open to question.

Further, Kiewit requested a $115 million loan from the federal government largely for harbour construction purposes and was not prepared to begin work on the quarry until the federal government formally committed itself to the harbour (Bryan Bennion, Northern Project Development, DIAND, personal communication).

On the other hand, if oil and gas are found in commercial quantities offshore in the Beaufort, then it is likely that a medium to deep draft harbour will be required. A number of studies have identified King Point

as a suitable site for the development of such a facility (see Chapter II and Appendix 1). The Monenco-Interlog consortium indicated that it would finance its project privately, based on its optimistic predictions for Beaufort activity. To date, however, neither sufficient hydrocarbon reserves have been identified nor have any of the Beaufort operators or government agencies indicated any need for a medium to deep draft harbour in the foreseeable future (Indian and Northern Affairs Canada, 1984c; Sue Cramp, Land Management Division, DIAND, personal communication).

6. Summary

Development of a deep-draft port at King Point to support the hydrocarbon industry in the Beaufort Sea-Mackenzie Delta region is on hold pending identification of commercial reserves which would justify large-scale production. It is unclear whether the reserves currently being delineated by Gulf Canada (Amauligak) will by themselves require development of a deep-draft harbour. If the preferred transportation mode in the long term is pipeline, then deep draft vessels would likely not be required. Nor would tanker transportation for short term or limited scale development require a deep draft harbour. Furthermore, to a large degree the location of large reserves offshore would determine the site of a deep draft harbour. Reserves east of Tuktoyaktuk, for example, might be more economically developed from the natural harbour at Wise Bay on the Parry Peninsula. Certainly the Beaufort oil and gas operators do not see the need to develop a support base at King Point now.

Nevertheless, it is wise to plan ahead, especially when considerable lead time is required to develop measures which would minimize negative environmental impacts. Assume, then, that eventually Beaufort oil and gas discoveries will require development and that King Point will be the future site of a multi-user harbour and quarry.

As noted earlier, decisions regarding development in the north Yukon are no longer the sole responsibility of the Minister of Indian Affairs and Northern Development. The leader of the Government of the Yukon has near-equal political strength, and both the Inuvialuit and the Council for Yukon Indians have clear responsibilities (the former through legislation and the latter through a land claims agreement in principle). The following chapter provides a detailed discussion of the current land management framework for the north Yukon.

CHAPTER IV

The Land Management Framework

1. Overview

The management framework for the Yukon North Slope comprises four elements: the Western Arctic (Inuvialuit) Land Claims Agreement; the land claims overlap agreements and related sub-agreements; the federal land use planning initiative; and the Government of Yukon's resource management model for the north Yukon, elements of which have been included in the land claims agreements.

The Western Arctic (Inuvialuit) Land Claims Agreement (Indian and Northern Affairs Canada, 1984a) set in place a basic framework within which certain controlled development could proceed. A special conservation regime for the North Slope is established by the Agreement and includes the creation of national and territorial wilderness parks, an environmental impact screening and review process for proposed developments and a wildlife management mechanism. Overlap agreements between the Inuvialuit and the Council for Yukon Indians (CYI) and between the Inuvialuit and the Dene/Metis and an agreement among Canada, the Yukon Territory and the Inuvialuit address related issues and contribute to the overall Inuvialuit land claims package.

Land use planning for the north Yukon including the North Slope is addressed in the Yukon - Canada Land Use Planning Agreement, the CYI Agreement in Principle, the Western Arctic (Inuvialuit) Land Claims Agreement and related sub-agreements. The CYI Agreement in Principle was not ratified by Yukon Indians and is being renegotiated. It is impossible to foresee exactly what changes will be made.

2. The Western Arctic (Inuvialuit) Land Claims Agreement

2.1 A Conservation Regime for the North Slope

Under the terms of the Western Arctic (Inuvialuit) Land Claims Agreement (the Final Agreement), a special conservation regime applies to the entire Yukon North Slope, establishing the conservation of wildlife and wildlife habitat and traditional native use as the dominant purposes. Other uses will be considered and could be permitted if it is shown that there would be no significant negative impact on wildlife, habitat or native harvesting or if it is decided that public convenience and necessity outweigh the conservation or native harvesting interests of the area. In addition, any development activity proposed for the adjacent nearshore and offshore waters are subject to screening and review to determine whether there will be a negative impact on present or future wildlife harvesting.

A national park has been established in the area of the north Yukon west of the Babbage River and north of the height of land. Other than an allowance for temporary and restricted industry use of Stokes Point, the North Yukon National Park will be zoned and managed as a wilderness-oriented park. Development activities inconsistent with the purposes of the park will be prohibited. A territorial wilderness park has been created on Herschel Island, although limited and carefully controlled development may be permitted at Pauline Cove.

The North Slope east of the Babbage River has been identified as an area in which controlled development may take place, subject to the environmental screening and review process outlined below. Development proposals in this area are to be examined according to the following criteria:

- significance of the area proposed for development from the conservation and wildlife harvesting perspective; - comparative evaluation of alternative sites;
- evaluation of potential environmental and social impacts;
- comparative evaluation of the conservation and harvesting interests against the public convenience and necessity values of the proposed development;
- evaluation of the capability of the proponent to carry out the project as required by the regulatory authority; and
- evaluation of the regulatory regime to ensure that terms and conditions are enforced and met.

2.2 The Environmental Impact Screening and Review Process

Every proposed development on the North Slope outside the park or relating to the North Slope and any offshore development which could have a significant negative impact on present or future wildlife harvesting is subject to screening by an environmental impact screening committee. This committee has members nominated by the Inuvialuit, the federal and territorial governments. Native organizations recognized through land claims as having rights to the North Slope which could be harmed by a particular development could also sit on the committee considering that proposal.

Development proponents are required to submit to the screening panel a project description during the preliminary planning stage. The panel will determine if the proposed development could have a significant negative impact and will provide the responsible government authority with a written opinion. If the panel decides that the development could have a significant negative impact, it will be subject to review, either by a government development/environmental impact review process acceptable to the screening committee (for example a federal environmental assessment review panel or review by the Regional Environmental Review Committee) or by the environmental impact review board established by the Final Agreement.

If the federal environmental assessment and review process route is chosen, then screening of the proposal could go through several stages, from a relatively low-key federal-territorial review using existing

mechanisms like the Land Use Advisory Committee, the Regional Environmental Review Committee and the Interdepartmental Environmental Review Committee through to referral of the project by the responsible federal agency to the Federal Environmental Assessment Review Office and public review by a high-profile environmental assessment review panel.

If the proposal is referred instead to the environmental impact review board, then the board would recommend to the appropriate government minister(s), based on its review and by majority vote, whether the development should proceed and if so, under what terms and conditions, including mitigative and remedial measures. The review board may also recommend further assessment and review and provide the proponent with data requirements. The responsible government authority would then decide, based on the review board's recommendations and other factors, whether the development should proceed and if so, under what terms and conditions. The government authority could request further impact assessment through whatever mechanisms are available to it. The review board process is similar to that of a federal environmental assessment review panel, except that the former has a legislative base, while the latter has been established through Order in Council.

If the government authority rejects or modifies the review board recommendations, it must give its reasons in writing within 30 days, and the decision would be transmitted to the interested parties and made public.

Until the entire environmental review is complete and the government authority issues its decision, no licence(s) or approval(s) can be issued which would have the effect of permitting the proposed development to proceed. If the project is approved by the appropriate government authority, then it would proceed in accordance with whatever terms and conditions have been set and in accordance with the normal regulatory regime (i.e., under the Territorial Land Use Regulations, territorial ordinances and other applicable legislation).

2.3 Wildlife Management Mechanisms

Under the terms of the Final Agreement, a joint government - native wildlife management advisory council will be established for the North Slope to provide for joint planning with regard to wildlife management in the North Slope by native people and governments. The council will provide advice to the appropriate ministers on all matters relating to the management, regulation, policy and administration of wildlife, habitat and harvesting for the Yukon North Slope, including:

- advice to the Porcupine Caribou Management Board, the Yukon Land Use Planning Commission and the environmental impact review board;
- preparation of a wildlife conservation and management plan for the Yukon North Slope;
- determination and recommendation of appropriate quotas for Inuvialuit harvesting of game in the Yukon North Slope; and
- advice on matters related to critical habitat in the Yukon North Slope.

Native and non-native rights regarding harvesting of wildlife on the North Slope are spelled out in the Final Agreement. Generally, Inuvialuit have the exclusive right to harvest wildlife on the Yukon North Slope.

2.4 The North Slope Conference

Finally, there is a provision in the Final Agreement for a Yukon North Slope Annual Conference to promote public discussion among native, governments and the private sector with respect to management co-ordination for the Yukon North Slope. No conferences have been held to date.

3. Overlap Agreements

3.1 Council for Yukon Indians (CYI) and the Inuvialuit

The overlap agreement negotiated by CYI and the Inuvialuit provides for the equitable sharing of economic development rights in north Yukon outside the national and territorial parks. It also states that:

- subject to agreements made between CYI and the Inuvialuit, the Inuvialuit will have sole native harvesting rights for wildlife on the North Slope and the Inuvialuit wildlife management regime will apply;
- the Vuntut Gwitchen of Old Crow will enjoy sole native harvesting rights in the north Yukon south of the height of land and the management regime in the CYI Agreement in Principle will apply;
- if possible, there will be a unified environmental screening and review process on the North Slope east of the park and in the area of north Yukon south of the height of land. The process will be the one defined in the Inuvialuit Final Agreement except that Old Crow and the Inuvialuit will have equal representation; and that
- if a unified screening and review process is not possible, then the Inuvialuit process will apply on the North Slope and the CYI process will apply south of the height of land.

3.2 Dene/Metis and the Inuvialuit

This agreement provides that:

- harvesting rights and priorities of Dene/Metis traditional harvesters may be exercised in those areas covered by the Inuvialuit Final Agreement where they have traditionally harvested wildlife;
- Dene/Metis traditional harvesters will have the right to appoint one voting member to all regional councils, committees or boards defined in the Inuvialuit Final Agreement when issues affecting species and the harvesting and habitat of species traditionally harvested by Dene/Metis are being considered. Included in the boards would be the Wildlife Management Advisory Board and the environmental screening and review bodies for the North Slope.

3.3 Points of Agreement on Outstanding Issues between the Government of Canada, the Yukon Territorial Government and the Inuvialuit pursuant to Inuvialuit Final Agreement

In order to address some outstanding issues about which the YTG was unhappy, YTG, Canada and the Inuvialuit reached an understanding on March 23, 1984 (Government of Canada et al., 1984). The relevant points of agreement included:

- YTG representation in the land use planning and environmental screening and review processes dealing with matters north of the watershed shall increase (within Canada's designees) as YTG's constitutional jurisdictions increase. In the event that the issues involved relate exclusively to Yukon jurisdiction, a majority of government designees shall be from the YTG; and
- comparable land use planning and environmental screening and review processes south of the watershed and north of the Porcupine and Bell rivers shall include native representation equal to that of government. The Inuvialuit interest in land use planning in Yukon shall be limited to the area north of the Porcupine and Bell rivers.

4. Land Use Planning

4.1 The Yukon - Canada Land Use Planning Agreement

Under an agreement between Canada and the YTG, land use planning in Yukon will "assist the federal and Yukon governments and the Council for Yukon Indians in applying social, cultural, economic and environmental policies to the management of renewable and non-renewable resources, thereby achieving their respective goals and objectives". The full participation of CYI in the planning process is explicitly addressed in the agreement (INAC and Government of Yukon Territory, 1987).

The Minister of the Department of Indian Affairs and Northern Development and the Minister of the Department of Renewable Resources, Government of Yukon, will be responsible for the Yukon Land Use Planning Program.

A three member policy advisory committee, composed of representatives from YTG, CYI and Canada will advise the ministers on the broad direction of the planning process. Its responsibilities will include advising on identification and priority ranking of planning regions, terms of reference for regional planning commissions and for preparation of land use plans, plan implementation, policy and budgets.

Regional planning commissions will be established for each planning region. Commissions will be responsible for specific terms of reference for land use plans, directing the Land Use Planning Office with respect to land use plan preparation, ensuring adequate public participation and the proper functioning of the planning process, recommending draft land use plans to the ministers, monitoring the implementation of approved land use plans and amending them as required, and preparing and administering budgets. The commissions will be composed of a representative from each of YTG, CYI and Canada and three additional

representatives nominated to include natives and non-natives in accordance with demographic ratios in the planning region. At no time will native and non-native representation be less than one third of the total membership of the commission unless the ministers and CYI agree. Once a plan is in place, the commission will be reduced in number to the YTG, CYI and Canada members and will monitor and advise on plan implementation.

A director of planning, appointed by DIAND in consultation with YTG and CYI, will prepare land use plans as directed by the commissions, act as a planning advisor to the commissions and provide linkage between the commissions and the land use planning office.

A land use planning office will be established in Whitehorse by DIAND and YTG and will be staffed by planners, other specialists and technical and administrative support services.

4.2 The Land Use Planning Provisions of the CYI Agreement in Principle

The CYI Agreement in Principle (Government of Canada et al., 1984) was never ratified by Yukon Indians. The provisions discussed below are therefore subject to change in response to the Yukon-Canada land use planning agreement and the final CYI agreement will be consistent with the latter.

Under the CYI Agreement in Principle, local Indian band councils would propose uses for adjacent band settlement lands, uses which are to be accepted by the planning body subject to good planning principles. All bodies which are created to assist government in land and water use planning and regulatory responsibilities would have at least 25% CYI representation.

The north Yukon is identified as an area of special environmental significance, but land use planning here would be in accordance with the process elsewhere in Yukon. Wildlife would be given special recognition and protection through the preparation of land use plans and through regulation and management in accordance with approved land use plans for the area. It should be noted that, although the term "north Yukon" is used in the Agreement in Principle, CYI authority ends at the watershed, where Inuvialuit authority begins.

Under the Agreement in Principle, the north Yukon would be divided into essentially the regions proposed by the Government of Yukon in 1980 (figure 16; see 4.5 below and Appendix 1 for discussion). CYI would be guaranteed at least 25% of the membership in any planning advisory structures applicable to areas "B" and "D" (subdivisions of Yukon's "possible resource management zone extension") and there would be at least 25% native membership in any planning advisory structures applicable to areas "A" and "C" (Yukon's national park and resource management zone, respectively). The latter requirement is in recognition of the role of the Inuvialuit north of the watershed. Area "C" is perceived as an area where controlled development could take place, subject to the concerns of the native organizations.

4.3 The Land Use Planning Provisions of the Western Arctic (Inuvialuit) Land Claims Settlement

The land use planning provisions of the Final Agreement note that two land use planning commissions, one for the Northwest Territories and one for the Yukon, will be established in order to co-ordinate land use planning for the overlapping Beaufort Sea region. The Final Agreement calls for a sub-group in each of the commissions that will deal only with the Beaufort Sea region and stipulates that native participation, including Inuvialuit participation, in each sub-group will be equal to government participation. The commissions are to make every effort to co-ordinate their work but it is unlikely that the Yukon and Northwest Territories Beaufort sub-groups will be one and the same body.

5. Northern Yukon Resource Management Model

In 1980, the Yukon Territorial Government presented its resource management model as an attempt to balance wildlife conservation and environmental protection with land based industrial development, particularly along the Beaufort coast (Government of Yukon, 1980). Although the model has not been explicity implemented, many of the elements and principles contained in the model have been incorporated in the Inuvialuit Final Agreement and the CYI Agreement in Principle.

The north Yukon was divided into four management zones: northwest (national park); Herschel Island (territorial park); central and northeast (special resource management zone); and south (possible extension of the resource management zone). These zones are illustrated in figure 16.

The special resource management zone that incorporates the King Point area contains a variety of resources, land uses and potential developments which would require, in the YTG's view, an integrated resource use management approach. YTG proposed the creation of a Special Resource Management Zone and a Northern Yukon Resource Management Advisory Committee to initiate the preparation of a land/resource use plan, to advise ministers with respect to the implementation of the management regime, to monitor resources management activities, to initiate required studies and inventories and to advise as to required adjustments to the management regime. The resource management regime would accommodate a variety of users and simultaneously provide measures required for the protection and conservation of wildlife resources and the environment.

6. Summary

The land management framework now in place for the North Slope is complicated but the decision-making bodies and the constraints placed on decision-makers are clearly identified. Proposed developments must be screened and approved by the government-Inuvialuit environmental impact screening committee and, if necessary, by the review board or its equivalent before approval by the government regulatory authorities can

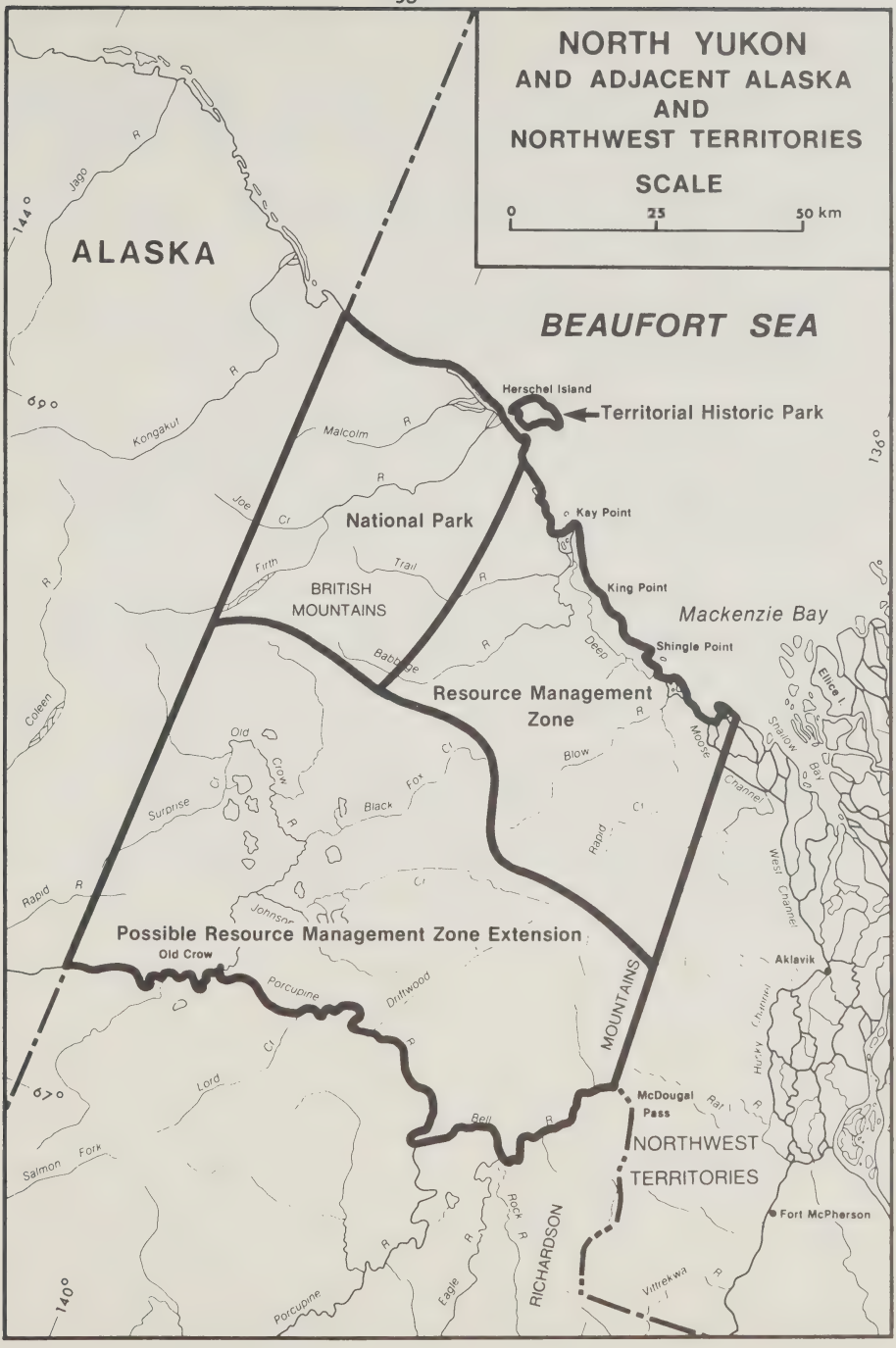


Figure 16 North Yukon Resource Management Model
Resource Management Zones (1980)

be granted. The Minister of Indian Affairs and Northern Development has the final decision-making authority and could reject the advice of the screening and review bodies, but only at considerable political risk.

The Government of Yukon can be considered a senior but slightly less than equal partner with the Government of Canada; the Inuvialuit and CYI are clearly senior advisers.

Proposed developments must also be consistent with the land use plan for the region. Unfortunately, in the case of the North Slope there is no plan currently in place and there is no indication that one will be available before 1989.

An amendment to the Order in Council withdrawing the relevant area of the north Yukon from disposition would be required before development could proceed. Regulatory requirements under the Territorial Lands Act, the Ocean Dumping Control Act, the Fisheries Act, the Navigable Waters Protection Act and other federal acts and territorial ordinances will continue to apply. Some of these are outlined in Appendix 4.

In short, development on the North Slope outside the National Park is no longer automatically prohibited by the withdrawal Order in Council. However, a proposal must satisfy a number of requirements before approval in principle can be granted, and a number of regulatory terms and conditions must be met before the development could proceed, including lifting of the withdrawal order for the area in question.

In the case of the North Slope, the potential environmental impacts of development are of paramount importance. The next section deals specifically with the environmental implications of a quarry and harbour development at King Point. This is the key issue, for if the environmental impacts are likely to be unacceptable, then development should not proceed under any terms, regardless of the management framework.

PART B

Possible Environmental Impacts of Quarry and Harbour Development at King Point

CHAPTER V

The Environmental Setting

1. Overview

King Point is part of the Yukon Coastal Plain, a physiographic region that includes all flat and gently sloping terrain between the Beaufort Sea and the Richardson, Barn and British mountain ranges (Rampton, 1982). The climate is polar maritime - long cold winters and short cool summers. A detailed description of the climate and physical and biological environment is provided in Appendix 2. A brief regional overview and a summary of current resource use is given here.

The Yukon coastal plain forms an integral part of an ecosystem which encompasses much of the northern Yukon and Alaska. Millions of birds frequent the coastal plain during the brief summer season, a large component of the Porcupine caribou herd moves through the region in most years, and grizzly and polar bear ranges overlap. Grayling are found in most streams and a number of other species of fish are resident in the lakes and rivers of the region. Arctic foxes are common and wolves, moose and other mammals, including muskoxen, are largely undisturbed in this northern area - one of the last remaining areas of true wilderness.

Important wildlife habitats are illustrated in figures 17 to 20.

Physiographically, the immediate King Point area is characterized by a gently undulating topography of predominantly glacial origin. It has a very high percentage of lake cover and massive ground ice and ice-rich sediments. Frost polygons are common. The surficial geology of the King Point region is illustrated in figure 21.

The Beaufort coastline near King Point is characterized by narrow gravel beaches and high, unconsolidated sediment bluffs which are retreating at rates up to 5 m per year through massive block slumping associated with melting ground ice. Figure 22 shows the shore zone types as mapped by Dobrocky (1985).

Drainage in the King Point ecodistrict is predominantly by small, sometimes beaded wetland streams that often merge, forming meandering creeks some of which in turn flow into larger systems like the Babbage River and Deep Creek. The entire coastal plain is underlain by continuous permafrost; the active layer is very shallow, and mineral soils are ice-rich, acid, frequently water saturated and gleyed. The overlying organic layer is composed mainly of undecayed water-logged plant materials.

Arctic tundra vegetation predominates in the King Point region and ranges in character from sedges and mosses in the wetter low-lying areas to tussock and trailing heath on the drier, well-drained areas.

IMPORTANT ARCTIC FOX HABITAT AND SPRING CARIBOU MOVEMENT IN THE KING POINT REGION, YUKON

class 1 habitat (Watson et al, 1973); most important arctic fox area, optimum denning sites

class 2 habitat (Watson et al, 1973); important arctic fox area, good denning sites

generalized spring movement of the non-calving component of the Porcupine caribou herd

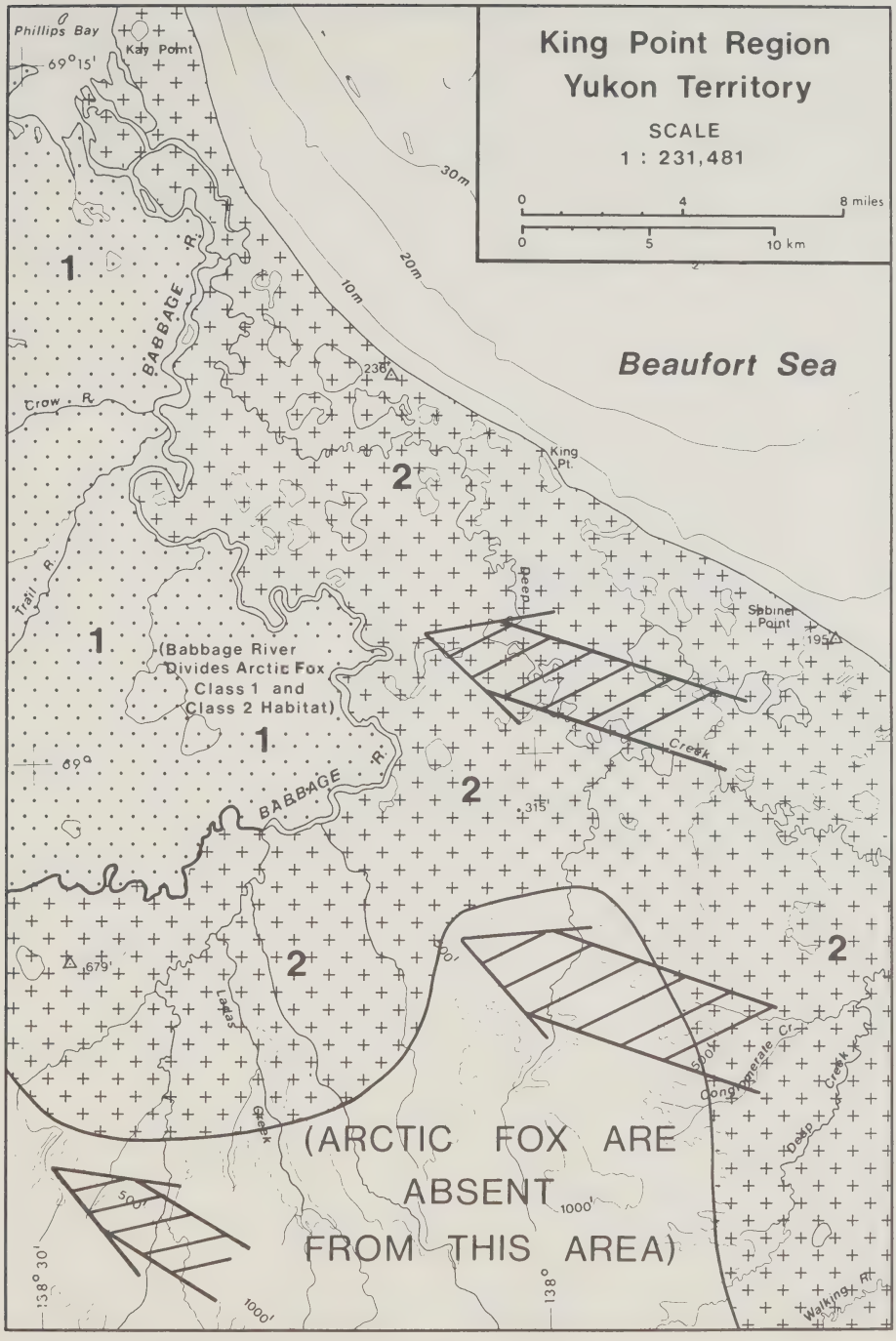


Figure 17 Important Arctic Fox Habitat and Spring Caribou Movement

IMPORTANT MOOSE AND GRIZZLY BEAR HABITAT IN THE KING POINT REGION, YUKON

class 3 moose habitat (Watson et al, 1973); ''poor'' moose wintering habitat but the best in the area

class 1 grizzly habitat (Watson et al, 1973); excellent denning habitat, high use

class 2 grizzly habitat (Watson et al, 1973); restricted denning habitat, common use

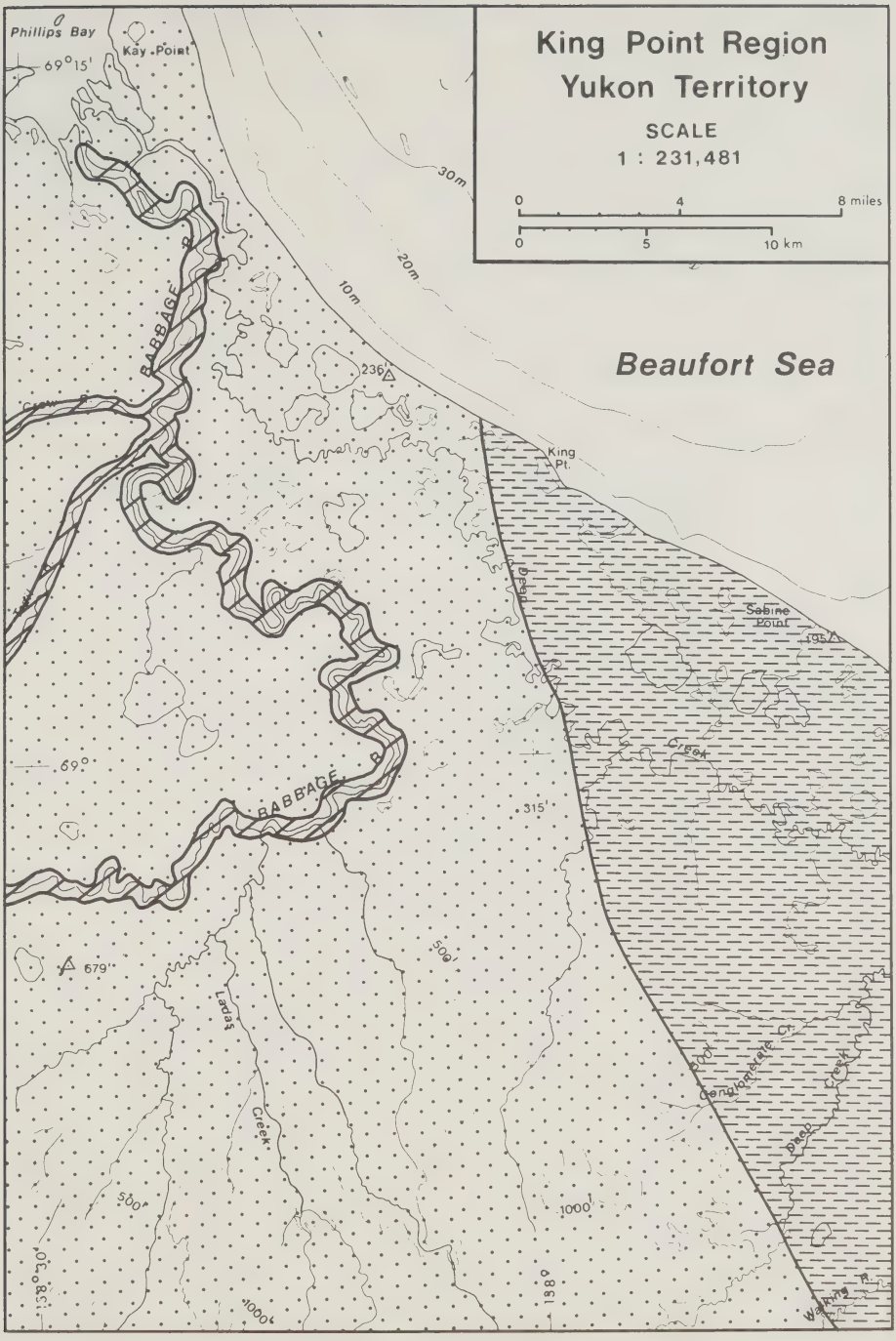


Figure 18 Important Moose and Grizzly Bear Habitat

IMPORTANT GOOSE AND TUNDRA SWAN HABITAT IN THE KING POINT REGION, YUKON

1973 snow goose staging areas
(Koski, 1975)

1974 snow goose staging areas
(Koski, 1975)

approximate 1981 snow goose staging area
(Dickson, 1985)

1974 white-fronted goose staging area
(Koski, 1975)

1975, 1981 white-fronted goose and
black brant staging areas
(Koski, 1977; Dickson, 1985)

1975, 1981 tundra swan concentration area
(Koski, 1977; Dickson, 1985)

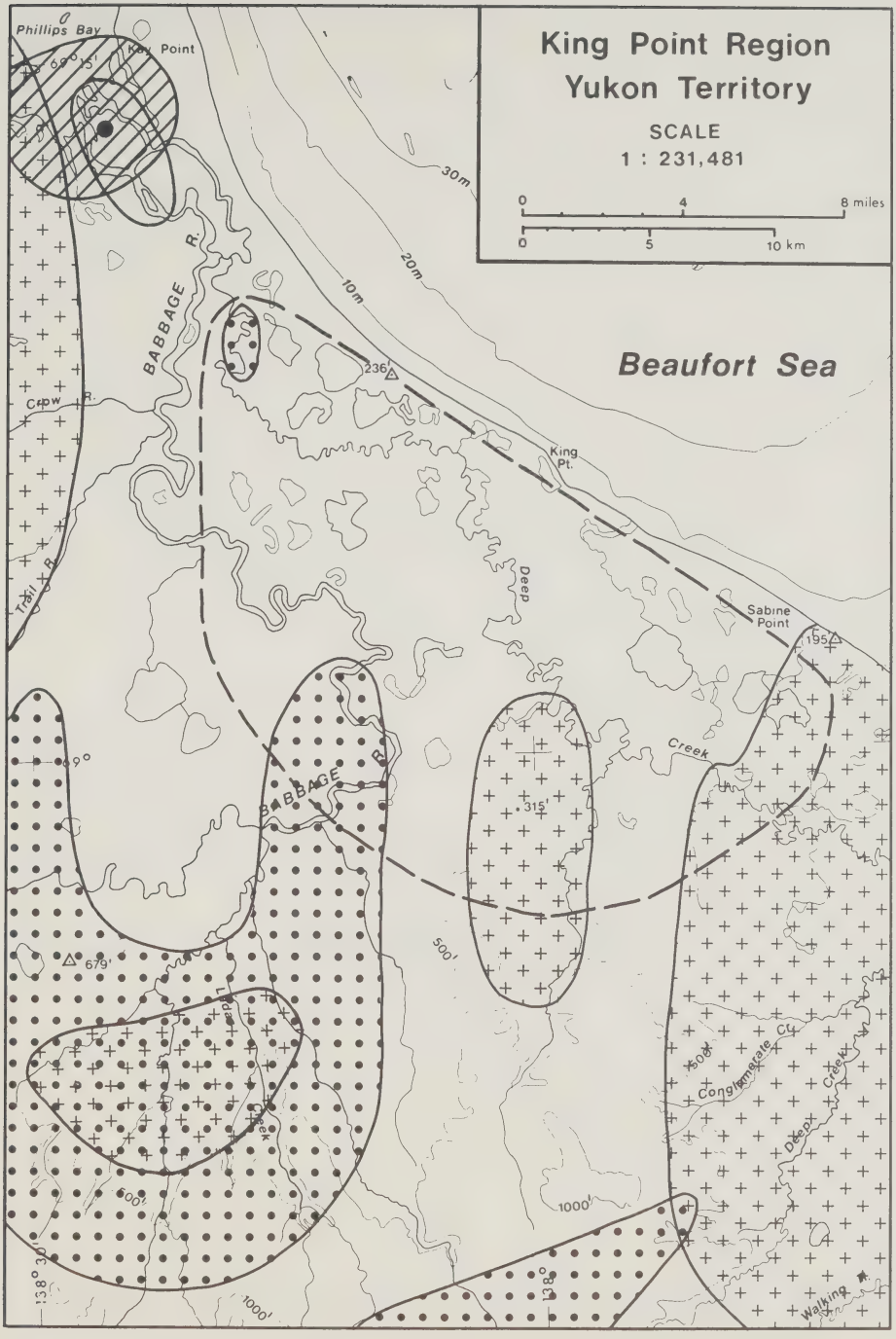


Figure 19 Important Goose and Tundra Swan Habitat

IMPORTANT DUCK HABITAT IN THE KING POINT REGION, YUKON

good

fair

poor

marginal

insignificant to nil elsewhere onshore

(sources: Watson et al, 1973; Gollop and Richardson, 1973; Dickson, 1985)

notes: no excellent onshore habitat;
Phillips Bay is an important area for glaucous gull, oldsquaw, surf scoter and arctic tern.

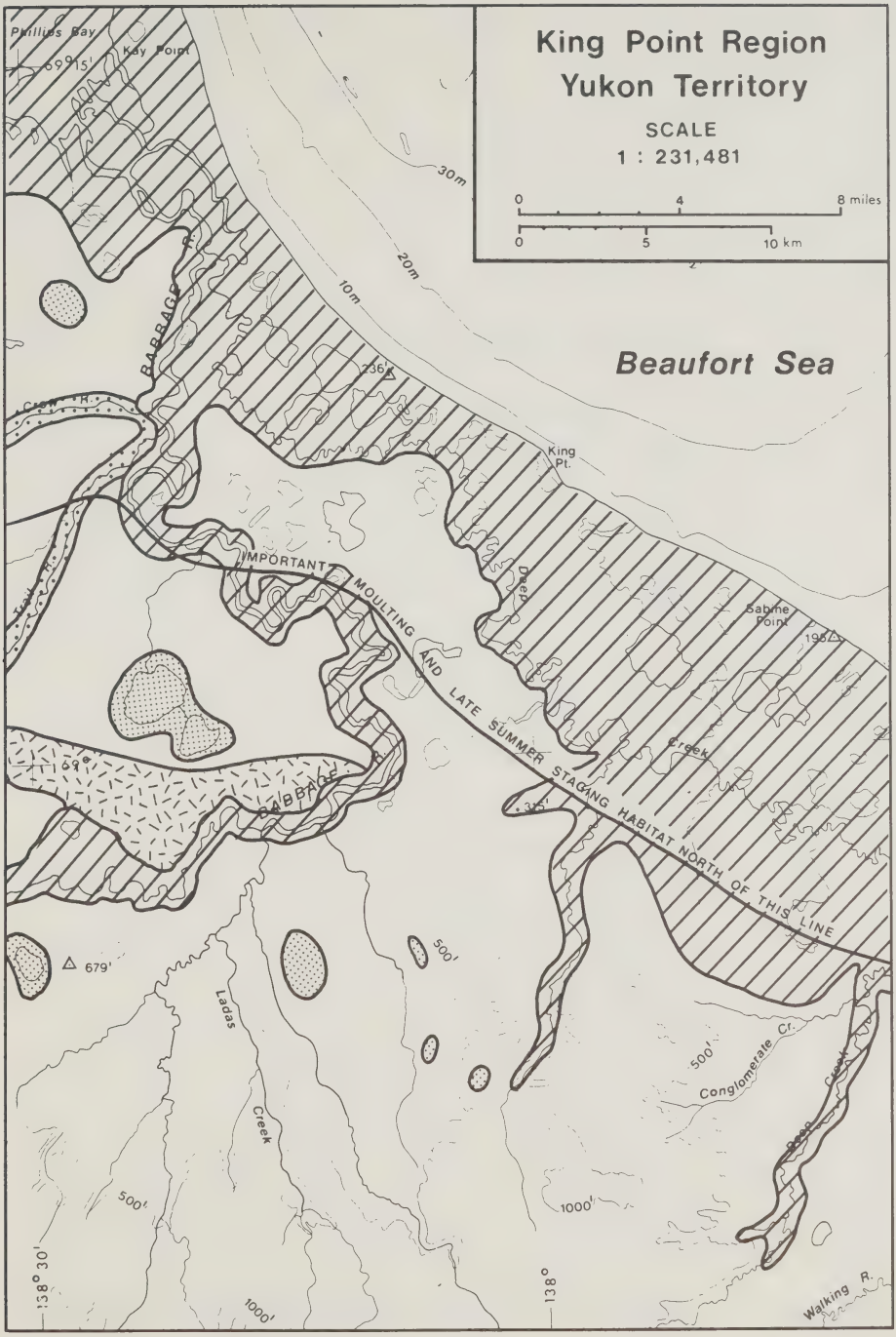
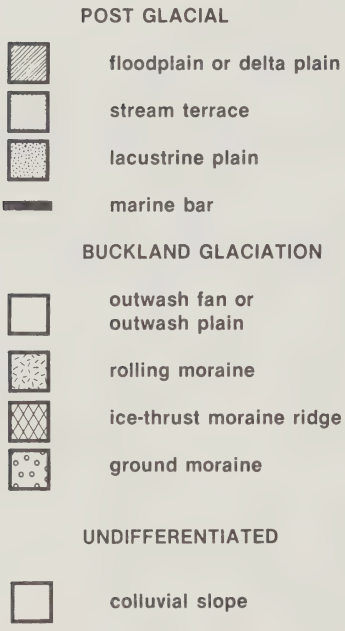


Figure 20 Important Duck Habitat

QUATERNARY GEOLOGY OF KING POINT REGION, YUKON



(from Rampton, 1982)

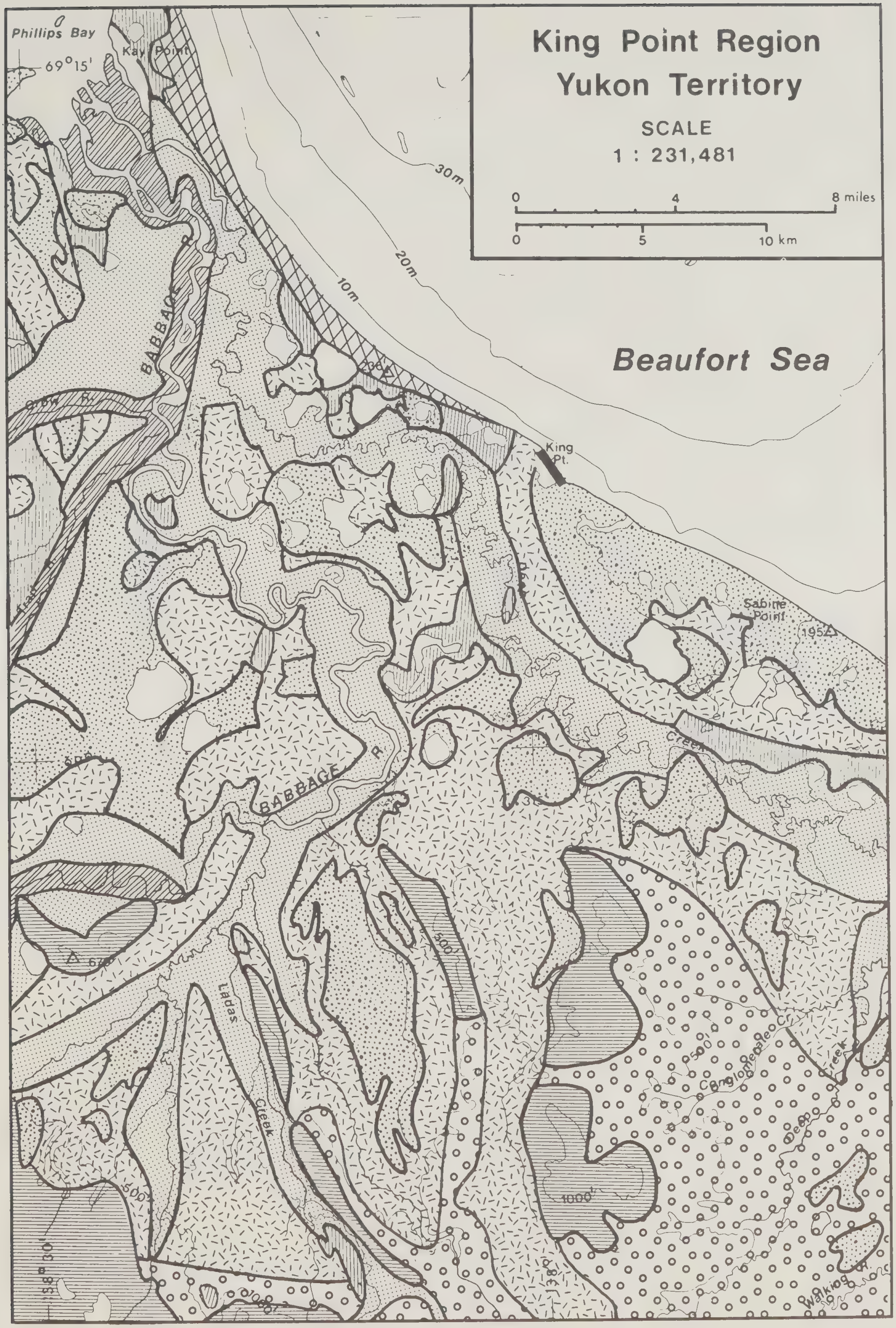


Figure 21 Quaternary Geology of King Point Region, Yukon

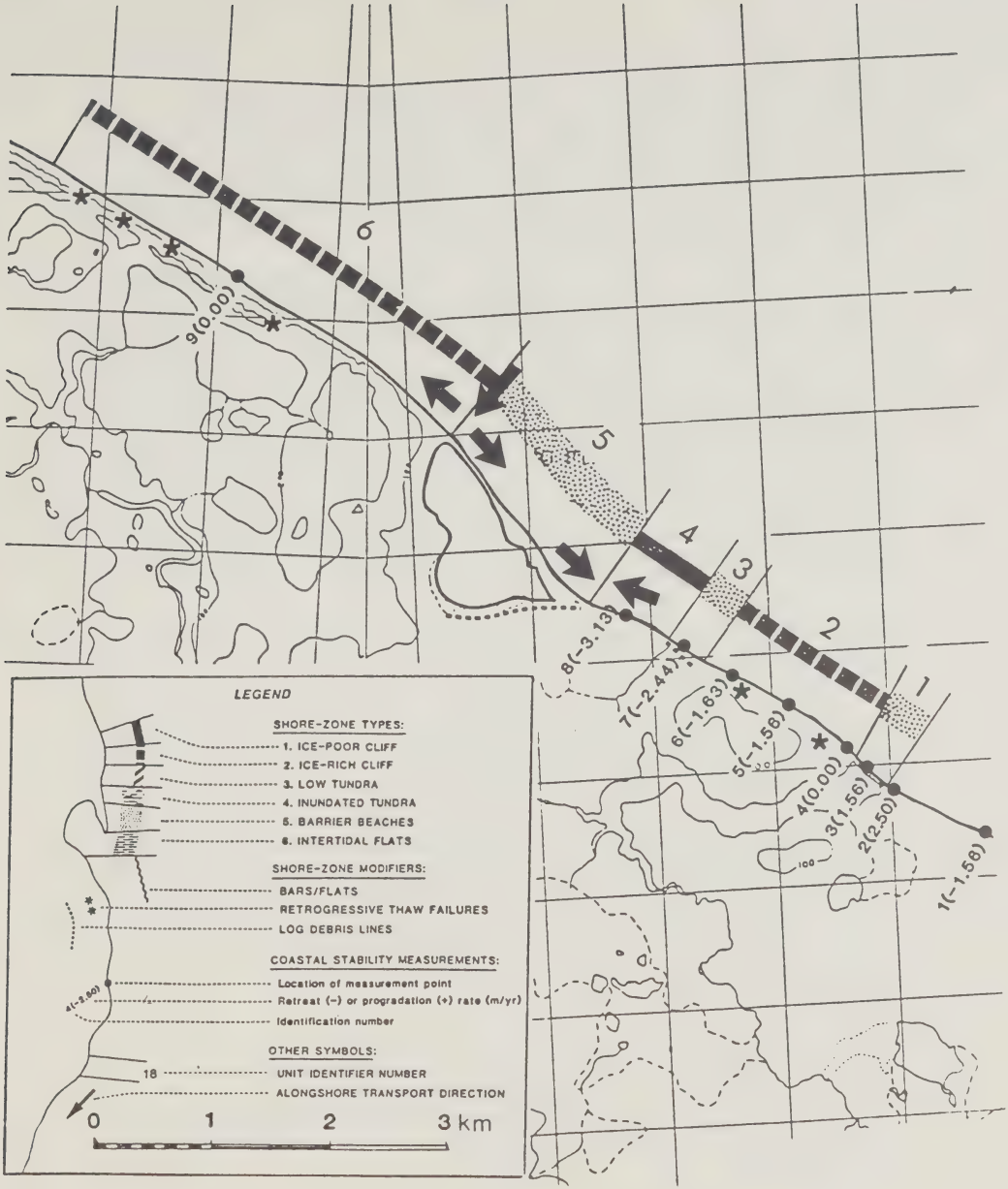


Figure 22 Shore Zone Types in the Area of King Point, Yukon (from Dobrocky Seatech, 1985)

2. Current Resource Use

2.1 Renewable Resource Use

Native people - the Inuvialuit, Dene and Metis - are virtually the sole users of the renewable resources of the King Point region, and their impact on the environment is very low.

There are no settlements at or near King Point. Individuals and small groups mainly from Inuvik and Aklavik have used and continue to use the area for a variety of purposes, including hunting, fishing and trapping.

King Point is about 60 km west of Shallow Bay, where beluga whales concentrate in large numbers in summer and are hunted by the Inuvialuit and Dene. There is little or no regular beluga hunting in the King Point area itself, primarily because equally good or better hunting areas are closer to the settlements. Residents of Aklavik and Inuvik use the King Point area for caribou hunting in summer and fall, although distance from the communities again reduces the frequency of hunting trips in the area. Moose are infrequently hunted along the lower Babbage and polar bear are hunted on the sea ice during winter and spring (Dome et al., 1982).

The only fur bearer trapped on the coastal plain is the arctic fox. Residents of both Aklavik and Inuvik have used the area infrequently for this purpose (Dome et al., 1982).

A small amount of domestic fishing occurs along the Yukon coast, particularly near Herschel Island and in the Shoalwater Bay area, but little or none is done near King Point.

If a harbour is established at King Point, then it is likely that increased hunting, fishing and trapping pressures will result. The degree to which these activities increase will depend on the nature of the base and the nature and enforcement of government and industry regulations regarding renewable resource use in the area. For example, there has already been some discussion about a future bowhead hunt in the Canadian Beaufort (News/North, 1985); a harbour at King Point could provide a convenient staging area.

2.2 Non-Renewable Resource Use

There is currently no non-renewable resource use (e.g., mining, oil production) in the King Point area, or indeed along the entire Yukon North Slope. As noted in Chapter II, however, there has been no shortage of proposals.

Offshore dredging for artificial island construction continues, but the closest site is about 60 km from King Point. Four onshore exploration wells were drilled along the Yukon coast in the 1960s but all were dry.

2.3 Tourism

Tourist activity in the North Yukon is very low: kayakers, canoeists and hikers visit the King Point area only rarely, and generally only when en route to and from other locations, e.g., the Babbage River. The establishment of the North Yukon National Park west of King Point will likely increase tourist traffic, as national parks tend to provide a "target" for tourist activity.

2.4 Scientific Investigation

A wide variety of scientific and industry-related activity in the King Point area occurs "annually" (almost all studies are limited to the summer months). The recent increase in interest in the King Point site for development as a harbour facility has resulted in an increase in related studies. In 1984, for example, caribou and waterfowl research, nearshore geological and hydrographic surveys, onshore geological investigations and studies of the coastal dynamics were undertaken. In March and April, 1985, the federal government supported an intensive onshore and offshore shallow drilling program intended to provide detailed information for civil engineering purposes, including wharf construction and onshore infrastructure placement.

3. Summary

Overall, current activities in the King Point area are extremely low-scale and the environmental impacts are negligible. However, the development of a harbour and quarry at King Point would introduce an entirely new level and scale of activity to the region, an activity which could have detrimental effects on the wilderness. In the following chapter, a profile of a possible quarry and harbour development is presented. In the subsequent chapter, the possible environmental impacts of such a development are discussed, a number of measures intended to reduce or eliminate the impacts are presented and some general recommendations are put forward.

CHAPTER VI

Profile of a Possible Quarry and Harbour Development

1. The Profile

It is difficult to predict with any certainty the precise nature of quarry and harbour development that could be undertaken at King Point. The following profile, an amalgam of the proposals made by Dome Petroleum, Esso Resources and Gulf Canada, Kiewit and the Monenco-Interlog consortium describes facilities that can reasonably be expected if a deep draft harbour is developed at King Point to support offshore oil and gas development and production activities.

1.1 The Harbour

Figure 12 illustrates a representative causeway and breakwater configuration (Dome et al., 1982a). This configuration is designed to provide protection from ice incursions, shelter from waves and at the same time, easy access to loading facilities in deep and shallow water. The causeway could be extended as far as 2.2 km offshore, to the 20 metre depth contour, and should be designed to minimize interference with sediment transport and fish movement.

1.2 Airport

An all-weather 2200 metre runway would likely be required at King Point. This would accommodate Boeing 767s and Hercules aircraft. Airport facilities would include aprons, ramps and terminal buildings in accordance with the type and frequency of aircraft expected and appropriate navigation aids and aircraft control equipment. The airport would be built on the flatest and most stable site near King Point and the runway would be aligned to minimize both crosswind landings and harassment of birds (mostly waterfowl) and other wildlife.

1.3 Storage and Workshops

The largest area at a typical northern shorebase is taken up by storage and repair facilities. Enormous supplies would be required to support Beaufort oil and gas development, where material for operations for the coming year is brought into the area almost entirely during the short summer season and stored until required. Much of the material can be stored outside, but many items must be stored inside heated and unheated warehouses.

The large amount of mechanical equipment used by the hydrocarbon industry, ranging from forklifts to marine vessels, requires repair services, garages and workshops.

Dome et al. (1982a) estimated that a facility to meet their needs at King Point would incorporate at least 75 hectares of territory. Given the

variety of potential users and the fact that the bulk of this land would be used for storage and repair facilities, the total area required for a full-scale, multi-user facility would probably be somewhat more, perhaps as much as 150 hectares. Figure 13 provides an illustration of the area required by similar developments elsewhere.

1.4 Liquid Product and Fuel Storage

A large tank farm will be required at a King Point shorebase to store fuel for marine vessels, aircraft, vehicles and power generation. Storage tanks in the north are normally contained within earthen dykes large enough to contain the fuel stored in the largest tank plus 10% of that contained in all additional tanks. Dome et al. (1982a) estimated that about 220,000 m^3 of fuel would be required annually by the first year of production, much of which could be stored at a King Point base.

1.5 Other Base Facilities

Navigation aids and communication facilities, including a microwave landing system, a high accuracy marine navigation system, VHF radio, microwave communications systems and satellite links, would be established at a King Point facility.

Power generation and heating requirements for a support base would be provided by diesel turbines in a physical plant facility. Also included in the physical plant would be water and sewage treatment plant, distribution pumps and a solid waste incinerator.

Onsite accommodation for 500 or more would be required at a King Point facility, especially if there is an associated quarry operation. This complex would include sleeping accommodations, gallery, dining room and recreation facilities.

Administrative functions, including materials warehousing, storage, control and handling, cost control, employee relations and training, contractor services and project management, would be located at a King Point site.

Dome et al. (1982a) noted that it is possible that a liquefied natural gas (LNG) facility and an oil terminal could also be developed at King Point, depending on the location and nature of offshore discoveries and on the transportation mode(s) ultimately chosen. Either facility would increase the land requirements; an LNG facility in particular would require considerable space.

1.6 Quarry

The Kiewit proposal to open a sandstone quarry south of King Point could be incorporated into the development (Peter Kiewit Sons Company Ltd., 1983).

If the quarry is developed, an all-weather road between the site and King Point would probably be required and could follow much the same route proposed by Kiewit. Quarry activities would likely be largely as

outlined by Kiewit but the routing of trucks in the King Point harbour area might be changed to accommodate dredging of the lagoon.

1.7 Roads

All-weather roads would be required within the harbour facility and probably between the harbour and the quarry. An all-weather road may be required between the harbour and the freshwater lake(s) selected for the water supply and an all-weather road to the Dempster Highway has been suggested by Dome et al. (1982a).

A King Point-Dempster highway link might also incorporate a pipeline (gas and/or oil) corridor, depending on the location of offshore discoveries and the chosen transportation mode(s).

2. Summary

Construction and operation of a facility at King Point such as that outlined above clearly could have a major, negative, environmental impact. However, a careful examination of the activities likely to cause disturbances, combined with good site-specific knowledge of the local and regional environment, would permit the identification of potentially serious problems and facilitate the design of appropriate mitigative measures. The next chapter addresses this subject in detail.

CHAPTER VII

Possible Environmental Impacts of Quarry and Harbour Development

1. Introduction

Discussion of the likely environmental impacts of a quarry and harbour development at King Point and a King Point-Dempster Highway all-weather road is made difficult by a number of uncertainties, not the least of which is the largely speculative nature of the development profile used here. Further complicating the issue is a general lack of site specific data and the scarcity of analogous developments elsewhere, especially harbour-related. Nevertheless, a number of studies have been done in an attempt to identify and quantify the most likely environmental impacts of this particular type of development (Dome et al., 1982c; Bureau of Land Management, 1982; Dickson, 1985; ESL, 1982; Federal Environmental Assessment Review Office, 1984; Fisheries and Oceans Canada, 1983a, 1983b; Gulf Canada, 1982; Indian and Northern Affairs Canada, 1983c; LGL, 1982; LGL and ESL, 1982; Peter Kiewit Sons Company Ltd., 1983; and Martell, 1983). The mitigative measures identified in this chapter have been derived from ones identified in these studies.

Table 1 provides a summary matrix of the potential (unmitigated) impacts of quarry and harbour development at King Point.

In the subsequent analysis, estimates have been made of the most likely residual impacts, although the term "residual" is probably misleading in that the estimates assume that:

(a) all necessary mitigative measures are identified and applied; and
(b) the application of these measures is nearly completely successful.

However, in counterbalance, one should remember that the King Point area itself does not appears to offer particularly significant habitat for most species.

2. The Marine Environment

Activities related to a King Point harbour that could produce measureable impacts on the marine environment include:

- sewage disposal;
- solid waste disposal;
- industrial effluent disposal;
- atmospheric emissions;
- artificial illumination;
- presence of breakwaters and causeways;
- human presence;

Table 1 POTENTIAL IMPACTS OF DEVELOPMENT ON RESOURCES IN THE KING POINT AREA

ACTIVITY	RESOURCE																						
	caribou	moose	muskox	grizzly bear	wolf	fox	other fur bearers	waterfowl	raptors	shorebirds	passerines	gulls	freshwater fish	marine fish	anadromous fish	seals	polar bear	beluga whale	bowhead whale	vegetation	coastal integrity
sewage disposal				P	P	P		X		X		X	X	X	X					X	
solid waste disposal				X	X	X	X					X	P		P		X			X	
industrial effluent disposal							X	X		X		X	X	X	X	P	P			X	
atmospheric emissions				X	P	P	P										P			P	
artificial illumination				X	X	X	P			X	X	X					X				
presence of breakwater and wharves												X			X						X
human presence	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
icebreaking												X				X	P	P	P		
underwater sound														P	P	X		X	X		
aircraft noise and presence	X	X	P	X	X	P	P	X	X			X				X	X	X	X		
dredging								P		P		X		X	X	P		P	X		X
presence of artificial structures on land	X	X	P	X	X	X	X	X		X	X		X		X					X	X
roads and associated vehicle traffic	X	X	P	X	X	X	X	X	X	X	X		X		X					X	
airborne noise from vehicles, operations, and blasting	X	P	P	X	X	X	X	X	X	X	X	X					P				
oilspills								X		X	X	X	X	P	X	P	X		P	X	
cumulative impacts	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

NOTE:

This matrix shows the potential measurable impacts of development on wildlife and other resources of the King Point area if only those mitigative measures concerned with human safety and engineering requirements are put in place ("unregulated" development). Impacts on wildlife populations are considered on a regional scale (the North Slope) and impacts on vegetation and coastal integrity on a local scale (the development zone).

X likely impact
P possible impact

- icebreaking;
- underwater sound generation;
- aircraft noise and presence;
- dredging;
- oilspills; and
- cumulative impacts.

2.1 Sewage Disposal

Disposal of treated sewage could produce localized nutrient enrichment and oxygen depletion at the outfall, particularly during winter when mixing in the water column is low. Although all marine species - from plankton to bowheads - could be directly or indirectly affected, application of the mitigative measures outlined below should reduce the impacts of sewage disposal to minor, very localized changes in species composition and abundance for plankton and benthic microalgae. Some indirect effects on benthic fauna which feed on the algal communities may also be noticeable.

Recommended mitigative measures include: secondary sewage treatment and chlorine disinfection; location of the submarine outfall where currents will permit adequate dilution and dispersion; and discharge from vessel holding tanks either into the treatment plant or in an approved area offshore.

2.2 Solid Waste Disposal

The dumping of solid waste in the Beaufort Sea is prohibited by the Ocean Dumping Control Act, except by permit, and accidental accumulations of solid wastes (e.g., steel pipe) would probably have an insignificant impact on available benthic habitat. Some fish and benthic communities could benefit from the appearance of hard substrate (unusual in the Beaufort) while other would be negatively affected through the loss of soft substrate. The overall impact would be consistent with the very minor amount of new habitat created.

Mitigative measures to minimize the likelihood that solid waste would be disposed of at sea include: enforcement of ocean dumping regulations; incineration of combustible solid wastes; and disposal of non-combustible solid wastes in an appropriate landfill site.

2.3 Industrial Effluent Disposal

Disposal of industrial effluents could have a serious impact on sea life, particularly if the effluent is toxic or oil-contaminated. Species at risk would include plankton, fish (particularly larval stages), sea birds and marine mammals. The degree of impact would vary directly with the nature of the effluent, and the amount, duration, location and timing of the discharge.

Prohibition of the discharge of toxic or oil-contaminated industrial effluent above carefully established standards would reduce the risk of harmful impact, and most accidental discharges would be avoided through

proper handling of materials. However, despite all precautions, accidental discharge may occur and appropriate contingency plans should be developed to minimize any impacts.

2.4 Atmospheric Emissions

The continuous operation of large engines and large heated buildings could create "heat islands" which could attract polar bear and arctic fox during cold periods. In addition, engine emissions could contain toxic gases, particulates and partially combusted hydrocarbons which could cause downwind impacts. The latter can be expected to have little or no impact for the foreseeable future as the total emissions are likely to be insignificant; one exception may be the creation of ice fog in winter through water vapor emissions. Atmospheric inversions could lead to the persistence of limited visibility.

Adherence to federal ambient air quality guidelines, assuming they are sufficient, will minimize air contamination while use of polar bear monitors, appropriate disposal of garbage and personnel training with regard to predators will minimize problems resulting from polar bear and arctic fox attraction to "heat islands". Nevertheless, there may be some destruction of "nuisance" bears which could have a measurable impact on the local population.

2.5 Artificial Illumination

Artificial illumination could attract some predators (polar bear and arctic foxes) in winter and birds during the dark hours of spring and fall. Mitigative measures, including limiting the intensity of artificial illumination consistent with work requirements and the elimination of other factors which could increase bird strikes, such as unlit structures adjacent to brightly lit structures, or further interest predators, such as edible garbage, would reduce local impacts on birds and impacts on predators to rare and unavoidable destruction of "nuisance" animals.

2.6 Presence of Breakwaters and Causeways

Breakwaters and causeways would have a variety of potential impacts, including destruction of existing habitat; creation of new and unusual habitat (hard substrate); alteration of existing current patterns, wave action, sediment transport and ice formation, movement and breakup; disruption of ice-bonded sediments; and creation of barriers to fish migration.

The most significant impacts are likely to be related to coastal erosion and nearshore fish migration. At King Point, erosion downstream of a causeway which projects into the current flow will increase while upstream of the barrier sediment deposition will likely increase (O'Connor and Associates, 1985). Waves from the northwest which reflect off the causeway could increase coastal erosion when they strike the shoreline. As noted in Chapter Five, the sediment cliffs in the King Point area are ice-rich, unconsolidated and easily eroded. Disruption of

the present regime could result in serious erosion and deposition problems and presents what is probably the major design challenge.

Construction of causeways or breakwaters can disrupt longshore current flow. In the Beaufort Sea, coregonids migrate within a narrow band of freshwater which flows parallel to the coastline. Causeways which extend across this band could alter the current regime in a manner which creates incursions of cold saline water through which young coregonids in particular will not move. In addition, incursions of cold saline water or other results of alterations in the current regime could result in long-term reductions of food supply, particularly amphipods and mysids (Bureau of Land Management, 1982). Studies in Alaskan waters (Craig and Griffiths, 1981; Envirosphere Company, 1985) indicate that the Prudhoe Bay causeway has caused significant negative impacts on the coastal movements and habitat of coregonids; the construction of a causeway at King Point could have similar results unless provision is made for one or more large breaches close inshore (Bill Griffiths, LGL Environmental Research Associates Ltd., personal communication). Dobrocky Seatech (1985) notes that breaches at King Point are unlikely to be self-cleaning, and dredging would be required to keep them open.

Some alteration of the local ice regime may result, but the impact of ice on the causeway or breakwater is likely to be greater than the reverse. The amount of existing bottom habitat lost and the amount of new, hard substrate habitat created is likely to have a measurable impact only on very local populations.

O'Connor and Associates (1985) report the presence of ice-bonded sediments offshore King Point. Some of these sediments are very close to the seafloor, within anticipated dredging depths in some cases. To avoid subsidence of bottom-founded structures, it would be necessary to ensure that degradation of this "warm" (-2° to -5°C) permafrost does not occur.

Prior to construction of a breakwater or causeway at King Point, extensive measurement and modelling of design options and coastal processes, principally longshore sediment transport and the local ice regime, must take place. Similarly, pre-construction studies of species composition, use of the area and intra- and inter-species dynamics on site-specific and regional scales are necessary to avoid unnecessary impacts. Research programs are required to address information gaps before the final design stage begins and structure designs must accommodate, to the maximum extent, known environmental concerns, principally longshore sediment movement, permafrost and fish migration.

2.7 Human Presence

The simple presence of humans in a wilderness area will cause a variety of disturbances, particularly to nesting, brood-rearing and staging marine birds, to fish through overfishing and through destruction of "nuisance" animals, especially polar bears. Human presence also attracts certain species, for example arctic foxes and gulls, which may increase in numbers and in turn increase predation on birds nesting on the tundra and barrier islands.

A number of mitigative measures, if strictly applied, could reduce impacts to acceptable levels. These include:

- implementation of environmental awareness training programs for all project personnel and implementation of a polar bear monitoring and removal program. Polar bears should be killed only as a very last resort. Industry policy should prohibit employees from leaving the immediate vicinity of the base. Hunting and fishing by employees should be prohibited;

- avoidance of birds at all times. Slaney (1974) developed a table showing the susceptibility of certain bird species to disturbance by camps and by humans on foot. Sensitivity to disturbance ranges from low for shorebirds to high for geese;

- application of government regulations to prohibit overfishing and overhunting by non-industry employees and prohibition of use of industry infrastructure, including roads, by non-employees;

- proper garbage disposal.

Despite all precautions, however, impacts will occur. Birds in particular could be vulnerable to disturbance, and some destruction of "nuisance" polar bears may be unavoidable.

2.8 Icebreaking

Potential impacts of icebreaking include direct mortality of seals through crushing in ice, behavioural disturbance of marine mammals, seal habitat loss, and creation of artificial leads for whales and seals and possible entrapment.

Impacts on marine mammals could be reduced by avoidance of known ringed and bearded seal concentrations, and polar bears, use of a narrow corridor rather than a broad one for ship transits and use of hull designs which encourage rubble infilling of ship tracks.

The residual impacts are likely to be most significant for ringed seals. Icebreaking activity is unlikely to kill adult seals as they are able to move out of the path of the vessel as it approaches, but pups in subnivean dens could be crushed, abandoned by the adult female or dislodged into the water at a stage when their insulative fat and fur layer provides inadequate protection. If a shipping corridor is established, seal mortality will likely be minimized as the animals learn to avoid the area. Seals prefer to establish dens in stable ice areas and it is possible that the corridor would be treated as an "unstable ice area".

The likelihood of entrapment of whales and seals in artificial leads is low, but more research in this area would be appropriate. Disturbance to marine mammals by the presence of icebreakers is unlikely to have measureable impact (some bears and foxes may be attracted but are unlikely to become a nuisance), and the impact of new habitat created for

birds (i.e., open water, overturned ice blocks) will be negligible on a regional scale.

2.9 Underwater sound

Underwater sound generated by vessels and by dredging operations may interfere with marine mammal communication and echo-location and could startle fish and cause habitat abandonment.

Underwater noise generated by ship traffic could increase the ambient noise level to the point where it would interfere with communication among seals. At lower intensities underwater noise could result in behavioural changes, including abandonment of certain areas. Numerous studies have been and are being conducted on the effects of underwater noise on marine mammals, but it is still too early to say what the effects might be. However, Mansfield (1983) estimates that sound levels from a tanker breaking through ice at full power would begin affecting communications among ringed seals and among bearded seals at a distance of about 40 km. It is possible the seals could become habituated to some increase in underwater noise levels, but intense masking noise will cause communication problems.

The major disturbance to beluga whales is likely to stem from underwater noise created by ship traffic, and the potential degree of impact is difficult to resolve on the basis of existing information. Recent studies in Lancaster Sound indicate that beluga whales and narwhal are very sensitive to ship noise in spring and will react by swimming away from the source, but the data is inconclusive regarding longer term impacts (LGL, 1985). Heavy ship traffic in and near Shallow Bay where beluga whales congregate in large numbers in summer could cause considerable disturbance. However, beluga whales apparently habituate to summer traffic to some degree (Dome et al., 1982), and regulation of this traffic would further reduce any disturbance.

The degree of impact on bowhead whales is unknown, but given the endangered status of these whales, any impact could be significant. Recent observations of very large bowhead concentrations off King Point (LGL, 1985) give additional cause for concern.

The impact of underwater noise on fish is poorly understood. The narrow coastal zone used by migrating coregonids may be subject to considerable ship- and dredging-related noise and further work in this area is probably warranted.

Migration measures to reduce impacts include: design of propulsion systems to reduce cavitation; identification of important habitat and avoidance of these areas during sensitive periods; and use of traffic corridors, subject to animal movements, to permit habituation. Vessels should maintain a minimum 2 km separation from marine mammal concentrations.

2.10 Aircraft Noise and Presence

Aircraft flying near hauled-out seals could cause the seals to dive and therefore experience thermoregulatory stress. Polar bear, arctic fox, marine birds and whales are also vulnerable to aircraft-related disturbance. The establishment of appropriate flight corridors, altitude restrictions and operational procedures, and curtailment of flights during sensitive periods, especially when weather restrictions would make the use of established corridors and procedures hazardous, should reduce impacts to acceptable levels in most cases. For example, minimum altitudes of 1500 m and 500 m should be maintained over snow geese and bowhead whale concentrations respectively. Despite all precautions, however, waterfowl - especially snow geese - could be subject to significant impacts.

2.11 Dredging

The potential impacts related to dredging include: short term loss of benthic habitat; entrainment and mortality of benthos and fish; short term increase in turbidity with consequent impacts on fish feeding and spawning; downstream increase in siltation and nutrient levels, and reduction in dissolved oxygen; altered bottom contours and consequent changes in local circulation patterns; altered sediment profile; disruption of ice-bonded sediments; and re-suspension of toxic substances in previously contaminated sediments.

The waters off King Point are highly turbid through the effects of coastal erosion and the Mackenzie River sediment plume. Nevertheless, application of mitigative measures to reduce the impacts of dredging is recommended. The measures include: dredging only during periods of limited biological productivity; no dredging in areas where oily or toxic wastes may have accumulated; site selection and harbour design to avoid the need for chronic redredging and to minimize changes in current patterns and coastal processes; deposition of dredge spoils in areas of normally high turbidity and low biological productivity; and dredging of beaches only where such dredging is environmentally acceptable. O'Connor and Associates (1985) note that ice-bonded sediments may be found during dredging and that further offshore, very soft sediments may create dredge channel slope stability problems.

Application of these measures will reduce the impacts from dredging to levels that are measurable only on a local scale e.g., local changes in bottom contours and benthic habitat. If fish concentrations are avoided, then impacts on fish populations will be minimal and short lived; if not, impacts could be significant.

2.12 Oilspills

Oilspills represent the single most significant risk to the marine environment. The risk of an oilspill is significant in any harbour area and may be greater in the Beaufort because of ice conditions. Impacts could be wide-ranging and very long-term and could include: oiling and subsequent mortality of birds and marine mammals; destruction of coastal vegetation and insect larvae providing important bird habitat; diffusion

of toxic ends through the water column and subsequent mortality of fish, particularly eggs and fry; and indirect effects associated with changes in availability or suitability of various food sources.

A spill would affect seals directly through contact and indirectly through contaminated prey species, but the likely degree of impact is not known. Variables including season, wind and current conditions, ice conditions and oil type make prediction extremely difficult, and the difficulty is compounded by the limited data base regarding seal distribution in the King Point region.

Studies have clearly shown that polar bears are susceptible to hydrocarbon-induced mortality, thermoregulatory stress and systemic disorders (Oritsland et al., 1981). As well, changes in distribution and abundance of ringed seals as a result of a large oilspill would affect polar bear populations and distribution. During winter and spring arctic foxes from coastal populations forage on landfast ice, primarily on polar bear kills and ringed seal pups. Any losses to the seal population or to the polar bear population through oil spill-related mortality could have an impact on arctic fox populations, but the impact is likely to be of only minor regional concern.

Indirect and direct impacts of oilspills on belugas are likely to be minor since whale mortality as a result of oilspills has not been documented and reduced food availability is unlikely to affect this species in a regionally significant manner. The same is likely to be true for bowheads, although the fact that bowheads are baleen whales (filter feeders) and are an endangered species does give cause for concern.

Bird species, particularly ducks using the coastal zone (eider, oldsquaw), shorebirds (especially phalaropes), loons, alcids (black guillemot), gulls, terns and to a lesser degree jaegers are vulnerable to oilspills. Black brant, the only goose species in the area whose migration is largely coastal, nest colonially or as dispersed pairs often just above the high tide line, and moulting and brood-rearing adults feed on vegetation in the littoral zone prior to fall migration. Brant are therefore very susceptible to oilspills.

Fish mortality has been observed only occasionally following oilspills, but sensitive larval stages could be affected in the coastal areas. An under-ice spill could be quite serious as toxic ends which would otherwise evaporate are dissolved in the water column. Coregonids using the narrow coastal zone of fresh water could be vulnerable as could demersal species exposed to oil-contaminated sediments, especially in those areas which do not receive large quantities of Mackenzie River sediment that would bury the oil-contaminated sediments.

A wide variety of mitigative measures would be required, including: development and application of satisfactory oilspill contingency plans; on-site storage of all necessary oilspill containment, recovery and disposal equipment; vessel storage of all equipment necessary for initial containment; site-specific mapping of sensitive habitat and development

of specific plans to protect these sites; and onshore storage of fuel in adequately bermed tank farms.

In the case of an oil spill, the following impacts are likely: all oiled birds will die; some mortality of oiled polar bears will occur; seal and whale mortality is unlikely, the latter even less so; some mortality of fish eggs and fry would likely occur, but unless very large concentrations are affected, the impact is unlikely to be regionally significant.

2.13 Cumulative Impacts

The cumulative impact on the marine environment of activities related to development at King Point is very difficult to estimate. This is because the development would be the first in the north Yukon of this type and magnitude and also because the likely impacts of any one aspect of the overall development are not easily defined. To further complicate the issue, the cumulative impact is likely to reflect a synergistic summation of individual impacts, as opposed to a series of independent, negligible to minor impacts. For example, habitat loss is likely to be some product of losses due to dredging, vessel noise, aircraft noise and presence, icebreaking and waste disposal, in addition to the physical loss of habitat. The impact of each activity may in itself have relatively little impact, but the net effect may be significant.

The best way to control the net impact of development is to carefully monitor both the impacts of individual activities and the overall responses of the environmental components or resources to the entire development and to compare these responses to pre-development patterns. Species which should be monitored particularly carefully include beluga and bowhead whales, polar bear, geese and arctic cisco. Coastal dynamics should be carefully monitored to document, evaluate and mitigate any changes which are a consequence of marine activities.

Results of the monitoring programs, coupled with related studies and modelling, can be fed back into the system to anticipate and further mitigate any negative impacts.

Moreover, operators should establish an environmental training program for all personnel, including contractors and subcontractors, and designed to inform them of the archaeological, geological and biological resources of the region, and particularly the importance of avoidance and non-harassment of wildlife resources.

3. The Terrestrial Environment

Activities related to a King Point development (including a quarry and an all-weather link to the Dempster Highway) that could produce measurable impacts on the terrestrial environment include:

- sewage disposal;
- solid waste disposal;
- industrial effluent disposal;

- atmospheric emissions;
- artificial illumination;
- presence of artificial structures (excluding roads);
- human presence;
- roads and associated vehicle traffic;
- airborne noise from vehicles, operations and blasting;
- aircraft disturbance;
- oilspills; and
- cumulative impacts.

3.1 Sewage Disposal

Sewage disposal on land would have a number of adverse impacts, including contamination of water courses, habitat destruction and attraction of wildlife with possible consequent destruction of "nuisance" animals. Fortunately, the impacts of sewage disposal onshore can be entirely avoided through secondary treatment of sewage and discharge at depth in the open ocean. Potential impacts of this preferable alternative are outlined in the section dealing with impacts on the marine environment.

3.2 Solid Waste Disposal

Solid waste disposal on land could have impacts similar to onshore sewage disposal. These include contamination of water courses, habitat destruction and attraction of wildlife. For example, improperly handled garbage will attract scavenging birds like ravens and glaucous gulls which could then displace other species. Gulls may compete with tern, red-throated loon and brant for nesting sites while ravens may compete with gryfalcons and rough-legged hawks for cliff sites (Dickson, 1985).

However, incineration of all combustible solid waste, including food, in an enclosed high temperature incinerator with appropriate emission controls and disposal of non-recycleable, non-combustible solid waste and ash in a solid waste disposal pit approved by the regulatory authorities would minimize impacts. Careful pit design would be necessary to avoid permafrost degradation and water contamination, and complete incineration of food would ensure that wildlife are not attracted to the disposal pit.

3.3 Industrial Effluent Disposal

Improper disposal of industrial effluent could create problems similar to onshore sewage disposal, with the potential added complications of toxicity and oil contamination. Impacts of improper disposal or accidental spills could cause very long term damage to vegetation, water courses and wildlife populations, particularly waterfowl and fish. Mitigative impacts would include incineration of effluents or transportation to southern disposal sites where appropriate and disposal onshore in approved pits lined with impermeable membranes when incineration or shipment south is not feasible. Despite all precautions, spills may occur and industry must develop contingency plans (approved by regulatory authorities) to deal with accidental spills quickly, effectively and efficiently.

3.4 Atmospheric Emissions

Degradation of air quality could be caused by engine exhaust emissions, refinery emissions, incinerator emissions and dust from quarry activities. Birds, particularly passerines, and vegetation are likely to be most affected. The latter will be especially affected if the emissions are acidic. Any significant loss in vegetation cover will have a corresponding impact on birds through loss of habitat; loss of insect prey or alterations to the plant community due to the effects of heavy dust cover (LGL, 1982) will also affect bird populations. The application of the following mitigative measures would reduce the impacts to near negligible levels: strict adherence to federal air quality guidelines and standards (assuming they are sufficient, and this may not be true during prolonged periods of stagnation and strong arctic inversions); the use of emission control units; and design of quarry operations to reduce to the extent possible dust generation, including the application of fresh water to dampen the working area in summer.

Exhaust emissions will cause ice fog and limited visibility during inversions. This is probably an unavoidable result of industrialization in the north and will be particularly severe during the winter months.

3.5 Artificial Illumination

Artificial illumination will attract wildlife, particularly birds and predators with losses through bird collisions with structures and destruction of "nuisance" animals. Passerines and bears, wolves and foxes will be affected but removal of items, especially garbage, which would increase the attraction for predators, personnel training regarding predators and appropriate illumination of all structures will reduce impacts. Artificial illumination in foggy conditions creates particularly difficult navigation problems for birds and could cause collisions with buildings, guy wires, masts and other structures. Relatively high towers that are located along a migration route and equipped with non-flashing lights are particularly hazardous during dark, foggy weather.

The installation of strobe lights would significantly reduce the risk to birds (Dickson, 1985).

Overall, impacts should be minimal except for grizzlies and possibly polar bears if "nuisance" bears must be destroyed.

3.6 Presence of Artificial Structures (Excluding Roads)

Construction will inevitably result in habitat destruction and exclusion of wildlife from areas where habitat has not necessarily been destroyed but has become inaccessible. Buildings will also attract wildlife, particularly predators. Building site selection and construction must be carried out with the knowledge that near surface, ice-rich materials occur in most areas.

Generalized habitat loss will affect some species more than others. Those species which are naturally low in abundance or have particular

habitat requirements are vulnerable and include grizzly bears (suitable den sites are limited, and the bears require large individual territories; naturally low numbers); caribou (large numbers of bull caribou use the King Point area for a limited period each spring (Martell, 1983 and Government of Yukon, 1983c); moose (stream and river valleys provide critical habitat; naturally low numbers); wolves (suitable den sites are limited; naturally low numbers); snow geese; and raptors (vulnerable to disturbance; some (peregrine falcon) are very rare and most are uncommon).

Studies indicate that nesting habitat is a limiting resource in northern Alaska and the same is probably true for the Yukon coastal plain (Dickson, 1985). As noted in Appendix 2, the greatest densities of water-oriented birds and passerines occur within about ten kilometres of the coast, the area where direct habitat loss due to construction is likely to be greatest. Habitat loss and habitat degradation may also occur if the natural drainage pattern is disrupted, causing ponding upstream and drying downstream. The net effect of these impacts will depend on the total amount of habitat lost and the value of that habitat. Loss of wetlands is likely to have a more significant impact than loss of dry upland tundra.

Proper care must be taken to avoid disruption of the permafrost regime. Organic and alluvial deposits are ice-rich, prone to shallow subsidence when disturbed and compressible when thawed; massive ice occurs within morainal and glaciofluvial units, and these areas are prone to extensive thaw subsidence and retrogressive thaw flow slides. Probably the least subsidence prone areas are deposits of primarily marine clay and silt and (not surprisingly) rock outcrops (O'Connor and Associates, 1985). These areas should be used as construction sites in preference to other, less stable areas.

Design and construction of facilities to minimize the amount of land required and the damage inflicted, revegetation, proper handling and disposal of garbage, proper handling and storage of food, and contingency planning for dealing with predators, especially bears, will reduce the total amount of habitat lost to wildlife. Facilities should be located as far from valuable habitat as possible. Drier upland areas should be used in preference to wetlands, for example. Where possible, construction should be restricted to the winter months when ice and snow pads can be used to minimize damage to vegetation.

Nevertheless, some habitat loss is inevitable. The physical presence of structures at King Point, including the airstrip, will result in direct habitat loss of an area somewhat greater than the immediate area covered by the structures but, if the development zone is minimized, an area that is generally insignificant in terms of the total available habitat on the coastal plain. Exceptions may be the loss of riparian habitat which is extremely important to the small north Yukon moose population and to grizzly bears and disruption of the Deep Creek valley for dabbling ducks. The most serious problem is likely to be the loss of grizzly bears, destroyed as "nuisance" animals or displaced because of human activity.

3.7 Human Presence

The most significant impacts of simple human presence will be overexploitation of wildlife and disturbances, including harassment, related to the physical presence of camps and individuals. Heavy foot traffic, camping and all terrain vehicle (ATV) traffic can cause long lasting damage to tundra vegetation, while fishermen could deplete the food source of terns, loons and mergansers (Dickson, 1985). Disturbance could be particularly significant during nesting/calving/spawning, brood-rearing and staging.

A variety of strictly enforced mitigative measures will be required to minimize impacts, principally: education programs for all project personnel to reduce or eliminate harassment of wildlife; prohibition of hunting, fishing and trapping by all project personnel; strict enforcement of federal and territorial regulations regarding wildlife and habitat conservation; prohibition of access to roads and facilities by non-project personnel; disposal of garbage and storage of food in a manner which will not attract animals; prohibition of any human activity within 1.6 km of peregrine nesting sites and within 0.4 km of all other raptor nesting sites; prohibition of the off-road use of ATVs or other vehicles; and restriction of camping to designated sites.

Species at greatest risk include raptors, caribou, lesser snow geese and grizzly bears. Although no falcons or eagles are known to nest in the immediate vicinity of King Point, some disturbance to raptors in the region is possible through increased access, including nest robbing for eggs and nestlings for illegal sale on the international market. Caribou do not normally calve in the King Point area and appropriate traffic controls on the roads, restricted access and prohibition of hunting by project personnel should significantly reduce the potential for unacceptable impacts. Fall hunting of staging snow geese would lead to increased mortality as well as additional disturbance during the important staging period. Other geese and ducks may also be vulnerable. The impact on grizzly bears could be serious if destruction of "nuisance" animals is required and would be severe if increased access leads to increased hunting. Again, limiting access to project personnel and prohibition of hunting by all personnel, in conjunction with the mitigative measures recommended above, would minimize impacts.

3.8 Roads and Associated Vehicle Traffic

Road access to King Point from the Dempster Highway presents the single greatest potential threat to the environment of the northeast Yukon. On-site roads would also have some impacts but, aside from the quarry haul road, these roads would create relatively minor problems. For the purposes of this discussion, it is assumed that an all-weather road from the Dempster Highway to King Point would be constructed.

Potential impacts are numerous and varied: disturbance to wildlife and habitat caused by road construction; road traffic and the road itself acting as a barrier to caribou migration; increased access to wildlife and habitat by hunters, trappers and fishermen; increased access to wildlife and habitat by tourists, resulting in increased general

disturbance; movement of vehicles on roads causing disruption to wildlife, particularly caribou and snow geese; wildlife mortality resulting from collisions with vehicles; increased caribou mortality as a result of easier footing for wolves; disturbance to the hydrologic and permafrost regimes; stream bank disturbance and run-off from road construction causing stream and lake siltation, destruction of aquatic flora and fauna and general habitat degradation; improper stream-crossing design, including culvert installation causing blockages to fish movements; chemical and contaminant pollution of water bodies during road construction and operation; and increased dust levels from vehicle traffic on unsurfaced all-weather roads acting as an insecticide or herbicide and causing consequent bird loss (see Atmospheric Emissions).

Virtually all wildlife species using the northeast Yukon could be directly or indirectly affected.

A number of mitigative measures would be required to minimize impacts. The first (and strongly recommended) measure would be to prohibit construction of an all-weather Dempster-King Point link. If an all-weather link is constructed, however, general mitigative measures would include identification of all significant habitat (e.g. wetlands) along the proposed road routing and final routing to avoid these sites; strictly limiting road access to project personnel; limiting road construction to the winter season whenever possible; and avoidance of major changes to the hydrologic and permafrost regimes through careful route selection and construction methods. Disturbed areas should be revegetated as soon as possible, preferably with native species, and wide buffer zones between sensitive habitat and roads should be established.

Mitigative measures directly intended to reduce impacts on the Porcupine caribou herd would include: no harassment of caribou under any circumstances, save emergency situations; road design and construction to permit free passage of caribou; cessation of all quarry haul road activity as required, between about early May and early August (precise timing would be determined through monitoring of the herd); halting of construction activities on the Dempster link and halting of vehicular traffic or deployment in convoys when caribou appear; and finally, prohibition of hunting by project personnel. The latter provision, combined with restriction of access to roads to project personnel should protect the herd from overhunting. Related studies of hunting along the Dempster Highway have shown that hunting pressure will increase significantly if open access is permitted. They also show that a non-hunting corridor parallel to the road cannot be enforced with respect to native hunters (Yukon Conservation Society, 1983). The presence of a raised gravel road bed, in the absence of vehicles and human activity, would not be expected to have a major negative impact on caribou movements unless crossing the road bed by caribou is made difficult through drifting snow, steep berm slopes or high berms which present a visual barrier. Rather, it is the nature of the activity on the road which presents the major potential concern (Bergerud et al., 1984). A road with a high frequency of vehicle passages will be perceived as a barrier by caribou, and of course the animals will react even more strongly to other human activity, particularly hunting (LGL, 1982).

Impacts on raptors would be reduced through strict application of the mitigative measures outlined in LGL (1982) for raptors. In particular, no roads should be built within 3.2 km of peregrine nesting sites, within 0.8 km of golden eagle nesting sites and within 0.4 km of gryfalcon, rough-legged hawk and bald eagle nesting sites.

The cessation of construction or operation of a Dempster link while lesser snow geese are present would be required to avoid disturbing the staging birds. The geese are normally present for about 16 days, between late August and mid-September, so this should not cause major disruption to industry schedules. Application of fresh water to all road surfaces to eliminate dusting of adjacent bird habitat would reduce impacts, particularly on passerines, through vegetation loss and insect mortality.

Impacts on fish would be reduced through the use of bridges rather than culverts for river and large stream crossings. When culverts are used for crossings of smaller streams, appropriate design would be required to avoid interference with fish movement. Road construction should be limited to periods which would avoid conflicts with fish migration and spawning. Finally, all additional measures necessary to reduce stream sedimentation should be employed, including right-angle crossings, buffer strips and bank stabilization.

As noted earlier, the only way to eliminate the risk of serious environmental impacts resulting from a Dempster link would be to not build the road. Failing that, the critical factor is whether access to the road could be restricted to project personnel whose leisure activities would be severely restricted (no hunting, fishing, trapping or other activities which could disturb the wildlife) and who would be given environmental briefings which would emphasize environmental protection. Without these restrictions, wildlife, particularly caribou, geese and grizzly bears, could suffer severe impacts.

Despite the application of all necessary mitigative measures, vehicle traffic would disrupt caribou and waterfowl, particularly snow geese, from time to time. Raptors nesting near the Dempster link would be subject to disturbance, especially during construction, but also during normal road operations (although some habituation would likely occur). Snow geese and white-fronted geese could be disturbed by vehicle traffic on the quarry haul road. Dust from the road surface would affect adjacent vegetation and act as an insecticide, thereby affecting passerines and other birds. Alterations in the hydrologic regime and vehicle traffic would affect fish and waterfowl, particularly loons.

3.9 Airborne Noise from Vehicles, Operations and Blasting

Airborne noise can have a variety of impacts, particularly if it is loud and occurs on a random basis. Potentially all wildlife species except fish could be affected through exclusion from habitat, long-distance sub-acute disturbance, and attraction to facilities (mainly predators).

A number of general and specific measures can be applied to reduce impacts. General mitigative measures would include: cessation of all quarry and haul road activities between about early May and early August

when caribou are nearby; installation of noise mufflers wherever possible; exclusion of non-project personnel from all access roads; and elimination of all sources of possible attraction to predators, especially garbage.

Specific measures directed toward caribou would include prohibition of blasting when caribou are within 3 km. With regard to the quarry operation, Martell (1983) said that "the problem for caribou is not specifically the quarry, it is the mechanism for getting the quarry material to the coast. If, in fact, it was acceptable to the proponents to move that quarry material from an inland site over an ice road in winter and stockpile it, I think you would have to conclude that the risk to caribou would be very low indeed". Quarrying activity can be controlled appropriately during the spring migration (including total shutdown) as can road traffic between the quarry and King Point and between King Point and the Dempster Highway.

Similar quarry and vehicle traffic restrictions should apply when lesser snow geese are present - usually for about 16 days, between late August and mid-September.

For raptors, LGL (1982) identified a number of restrictions based on species:

- peregrine falcon: no human activities within 1.6 km and no major construction or other noise producing activities such as mining, blasting and aggregate grinding within 3.2 km between April 15 and August 31.

- golden eagle: no major ground activity within 0.8 km and no habitat disturbance within 0.2 km between April 1 and August 31.

- gyrfalcon: no major ground activity within 0.4 km and no habitat disturbance within 0.2 km between February 15 and August 15.

- rough-legged hawk: as for gyrfalcon, between April 15 and August 31.

- bald eagle: as for gyrfalcon, between March 15 and August 31.

All nesting sites, whether occupied or not, should receive the same protection as occupied sites, and alteration of limited, high quality habitat which could significantly reduce prey availability (e.g., wetlands) within 25 km of nest sites should be prohibited (Bureau of Land Management, 1982). Pesticide use would also be prohibited, except possibly approved non-persistent insecticides at the harbour and quarry sites.

Waterfowl habituate to some degree to regular low-level "background" noise but would be startled by sudden loud noises at random intervals (e.g., blasting). Lesser snow geese could be especially vulnerable.

Wiseley (1974) found that lesser snow geese would not feed within 80 m of a gas compressor station. The greatest concern in North Yukon, however, would likely be aircraft noise and presence as discussed below. Residual impacts would likely include some disturbance to caribou and waterfowl, habitat loss and habitat exclusion for many wildlife species and some risk that "nuisance" predators would have to be destroyed.

3.10 Aircraft Disturbance

Aircraft noise and presence could disturb most species of wildlife in the north Yukon, particularly lesser snow geese, raptors and calving caribou.

Davis and Wiseley (1974) and others have observed that fall staging lesser snow geese are highly sensitive to aircraft overflights, flushing when aircraft are as far as 14 km away or 3000 m above. Repeated overflights could significantly reduce available feeding time and may force the geese to leave the staging grounds with insufficient fat reserves. Brant and lapland longspurs have also exhibited negative reactions to aircraft overflights while gulls and jaegers may increase their predation success when other birds are disturbed and leave their nests.

Mitigative measures intended to reduce aircraft-related impacts would emphasize the establishment of flight corridors, altitude restrictions and operational procedures based on species sensitivity, distribution of important habitat and seasonal variations in habitat use. For example, take-off and landing procedures should minimize over-land traffic (while maximizing altitude while over land) and maximize noise reduction. Traffic over Phillips Bay and the Babbage delta should be minimized, as should traffic near snow geese.

Flights should be curtailed during periods when wildlife is particularly sensitive and especially when weather restrictions would make the use of established corridors and procedures hazardous.

Aircraft activity has the potential for disturbing caribou movements, raising the energy requirements of the animals (Gunn, 1983). However, caribou are present in low numbers or entirely absent from the King Point area in all periods but the spring migration, and proper alignment of the runway and flight paths, restrictions on aircraft movement and ceilings and other control measures could minimize the impacts. The fact that the area is not part of the calving grounds eliminates a major concern. With regard to aircraft altitude, Miller and Gunn (1979) recommended that aircraft should fly at least 300 m above ground level (agl) from December through April and at least 600 m agl for the balance of the year.

Aircraft overflights of traditional lesser snow geese staging areas should be avoided between August 15 and September 30, except in the case of extreme emergencies and then, if at all possible, only at altitudes greater than 1500 m agl. Exact timing would be determined by careful monitoring of snow geese arrival and departure. Similar measures should apply between July 15 and August 15 to areas where moulting waterfowl are concentrated (LGL, 1982).

The Canadian Wildlife Service is conducting studies to determine the altitude at which aircraft least disturb lesser snow geese; preliminary results indicate that overflights at 100 m agl may disturb geese less than overflights at 1500 m agl (Dickson, 1985). Further work in this area is clearly required.

LGL (1982) has provided the following guidelines for raptors:

- peregrine falcon: 500 m minimum altitude within 1.6 km lateral distance, from April 15 to August 31;
- golden eagle: 300 m minimum altitude within 800 m lateral distance, from April 1 to August 31;
- gyrfalcon: 300 m minimum altitude within 400 m lateral distance, from February 15 to August 15;
- rough-legged hawk and bald eagle: as for gyrfalcon, from April 15 to August 31.

Despite the application of the above measures, some aircraft-related impacts are likely. Staging white-fronted geese, black brant and moulting ducks may be disturbed from time to time. Lesser snow geese are particularly sensitive to aircraft, and some disturbance to staging birds is probably inevitable. Careful monitoring of this species will be essential. Some caribou cows and calves (more sensitive to aircraft disturbance than bulls) may use the King Point area in August and September and some (minor) calving may occur nearby in the spring. Impacts should be low, however, especially if aircraft maintain minimum 300 m altitudes.

3.11 Oilspills

Oilspills on land would kill vegetation and could contribute to the degradation of the underlying permafrost. Pollution of nearby waterbodies, oiling of waterfowl, mortality of aquatic insects, fish eggs, fry and possibly adults, loss of some types of vegetation (especially mosses, lichens and many shrubs) and the potential for oiling of polar bears are also possible impacts of a spill.

The most effective means of dealing with oilspills is to prevent them. Preventive measures would include extensive training of personnel in oilspill prevention and clean-up procedures, construction of impervious, bermed tank farms with a capacity equal to that of the largest tank plus at least 10% and installation of all appropriate safety devices, operational procedures and backup equipment. Contingency plans for oilspill containment, cleanup and disposal must be developed, tested frequently and revised as required and all required oilspill cleanup must be stored on-site.

If a King Point development is permitted, chronic and acute spills of varying sizes will occur. The degree of impact will vary with the timing, location, size and type of spill and the effectiveness of contingency plans. Impacts, particularly on aquatic insects and some

vegetation types (Dickson, 1985) would be long-term. If oil enters streams and other waterbodies, the impacts would be widespread, affecting fish, bird and some mammal populations for varying periods.

3.12 Cumulative Impacts

As is the case for the marine environment, the cumulative impact on the terrestrial environment of a King Point development is difficult to predict but will certainly be more than the sum of individual, insignificant impacts. For example, what would be the effective total habitat loss which would result from the combination of uncontrolled or poorly controlled airborne noise, aircraft presence and an operational Dempster link, coupled with a significant human presence and a focus of visible activity at King Point and a nearby quarry? If one adds chronic oilspills and access to the Dempster link by non-project personnel, then the total potential impact rapidly increases and could be extreme.

As a cautionary note in his submission to the Beaufort Environmental Assessment Review Panel, Martell (1983) said, "many of the undesirable effects of a localized industrial activity can be successfully mitigated, but the effects of a complex of exploration and development sites, the accompanying air and ground access routes and the collection and delivery systems for industrial products have both cumulative and synergistic effects on caribou". The same is true for any other species. Nevertheless, the careful application of the mitigative measures proposed above can limit impacts associated with a quarry and harbour at King Point to acceptable levels.

CHAPTER VIII

Summary of the Major Environmental Concerns

The physical and biological environment of the King Point area and the potential impacts of development have been outlined in the previous chapters. Clearly, while the wilderness of the North Slope and the north Yukon is extremely important and productive, the King Point area itself, with certain exceptions, offers little that is not found elsewhere in the region. The area is beautiful, but it is largely typical of the North Slope - not exceptional.

Significant habitat does exist in the vicinity of King Point for caribou, lesser snow geese and bowhead whales, and Deep Creek is very important to moulting ducks in some years. The loss of habitat could have serious impacts on these species. Similarly, development would destroy much of the physical beauty of the lagoon, the barrier bar and the immediate surroundings, particularly if proper care is not taken to accommodate ice-rich materials and the dynamic coastal regime. Nevertheless, if development along the lines outlined earlier is considered essential, it could proceed under terms and conditions which would ensure that environmental impacts are minimized and the wilderness of the northeast Yukon left essentially untouched. Habitat loss at King Point would be unavoidable but could be contained so that wildlife, including caribou, snow geese, bowhead whales and grizzly bears, is not put at risk.

Biologists should be involved in development at King Point from the early planning stages through post-construction monitoring and project abandonment. Early involvement would go far in ensuring that sensitive habitat is identified and protected, that mitigative measures are put in place from the beginning, that industry complies with environmental terms and conditions and that ineffective or unnecessary mitigation measures are remedied. Dickson (1985) suggested that lesser snow geese and raptors are particularly vulnerable to disturbance and should be monitored closely in the event that industrial development proceeds at King Point. Martell (1983) recommended that particular attention be paid to the impact of development on the Porcupine caribou herd.

Further investigations of the wildlife that uses the King Point area are clearly required. Dickson suggests that at least two more years of field studies are required to provide the baseline data necessary to evaluate the impacts of development on birds. The same may be true for all other species of wildlife, including marine mammals, which frequent the King Point area. It is true for the coastal regime, particularly when considering the restrictions that current flow, storm surges, ice dynamics and sediment transport would place on harbour and breakwater construction (Peter Morgan, Atlantic Geoscience Centre, personal communication).

It must be emphasized that development in the King Point area is neither desirable nor necessary at the present time; nevertheless, based on the information available, it is clear that some limited scale development could

proceed without destroying the wilderness values of the region. However, certain institutional arrangements are necessary before any development proceeds, and these are discussed in the next section.

PART C

Recommendations and Conclusion

CHAPTER IX

A Conservation Framework for the Northeast Yukon

1. Introduction

If the northeast Yukon is to be placed within a conservation framework designed to protect the wilderness, it must meet two central criteria: it must be recognized as an ecosystem of internationally acknowledged significance and it must be given legislative protection that is recognized and enforced by the Government of the Yukon, the federal government, the Inuvialuit and the Council for Yukon Indians. The first criterion would serve to provide as far as is possible the international guarantees (or pressures) that would ensure that industrial developments proceed only under very strict terms and conditions. The conservation framework is doomed to failure if it does not meet the second criterion.

There are three interrelated sub-elements to the central criteria. First, it must be shown that the northeast Yukon deserves national and international protection. Second, the legislated protection must be environmentally sound and consistent with the criteria established for the appropriate international designation. And third, this designation must carry sufficient political and moral authority that governments would hesitate to permit activities which are inconsistent with the purpose of the designation.

Whether the northeast Yukon deserves national and international recognition and protection is addressed in this chapter through the application of criteria and guidelines developed by the Task Force on Northern Conservation (Task Force on Northern Conservation, 1984). An examination of applicable federal and territorial legislation to determine the most appropriate legislative option from the environmental and political perspective, and the application of UNESCO criteria for Biosphere Reserves address the second sub-element. Biosphere Reserve status would satisfy the third sub-element.

Implicit in the application of the Task Force criteria and the Biosphere Reserve criteria is the view that the north Yukon represents a single ecosystem and must be managed from that perspective. The national park boundary must not dictate separate management regimes for the park and for the remainder of north Yukon.

2. UNESCO's Man and the Biosphere Program - Biosphere Reserves

The Man and Biosphere (MAB) concept of a biosphere reserve involves a protected core of relatively undisturbed landscapes in association with adjacent areas ("zone of co-operation") that demonstrate various ways in which similar landscapes and their resources are managed and used to meet different human needs. Table 2 summarizes the application to the north Yukon of MAB criteria for a biosphere reserve and shows very clearly that

TABLE 2

Application of Biosphere Reserve Criteria to the North Yukon

Criteria	North Yukon
1. protected core area	North Yukon National Park Herschel Island Territorial Park
2. zone of co-operation	area of north Yukon not within core area
3. local interdisciplinary biosphere reserve group	Wildlife Management Advisory Council (North Slope)
- organizations responsible for core area	Parks Canada, Inuvialuit, CYI
- organizations responsible for management of adjacent area	YTG, DIAND, DFO, DOE, YTG, Inuvialuit, CYI
- research organizations	ACUNS, federal and territorial agencies, industry
4. management framework for the zone of co-operation	Inuvialuit Final Agreement CYI Agreement in Principle Porcupine Caribou Management Agreement federal and territorial legislation
5. monitoring and research co-ordination organizations	Wildlife Management Advisory Council (North Slope) Research Advisory Council

the area is an excellent candidate, perhaps an ideal candidate, for formal designation as a biosphere reserve.

MAB places a great emphasis on the importance of applying ecological research and environmental monitoring programs toward solving land use and resource management problems. It actively involves user groups and resource managers in research decisions to ensure co-ordinated, interdisciplinary research programs, incorporating social science components in the studies and extending the concept of conservation from core protected areas to adjacent areas (Commission on National Parks and Protected Areas, 1982). All of these factors are critical components in ensuring the long term well-being of the north Yukon.

The international recognition and attention that would accompany the establishment of the north Yukon as a biosphere reserve would provide much of the political protection that the area requires. This step, combined with formal, legislated environmental protection for the northeast Yukon would ensure the future of the regional as wilderness. Limited, carefully controlled development would proceed only after thorough scrutiny and only under terms and conditions which would protect the wilderness.

3. The Report of the Task Force on Northern Conservation

The Task Force on Northern Conservation recommended "a two-fold approach to conservation that provides for balanced, integrated resource use for most regions of the north and establishment of a comprehensive network of areas that require special protection for a variety of reasons" (Task Force on Northern Conservation, 1984). Integrated resource management requires comprehensive planning and an active, forward-looking decision-oriented approach in contrast to the existing regulatory, reaction-oriented regime; it requires taking into account all the land, water and living resources of each management areas, their interrelationships and the interrelationships of each management area with adjoining areas. The goal is to develop each management area in a manner which will yield optimum sustained productivity of all resources.

In addition to the application of integrated resource management throughout the north, the Task Force recommended setting aside a comprehensive network of land and water areas to "preserve their primary use for cultural, scientific, educational, aesthetic, recreational or biological purposes". These areas would have to meet certain selection criteria and be managed according to a set of protected area guidelines. In tables 3 and 4, these criteria and guidelines are examined for the northeast Yukon.

The results of this evaluation show that the northeast Yukon is indeed worthy of designation as a "protected area" and that it can be managed in a manner which would ensure its continued viability.

TABLE 3 Task Force on Northern Conservation

Selection Criteria as They Relate to the Northeast Yukon

A) Selection Criteria

Does the candidate area:

i) contain sites of significant cultural, archaeological, historic or traditional resource-gathering value?	probable[1]	
ii) contain examples at specific sites of outstanding or unique landforms or geological features such as the pingos of the western Arctic?	yes	(e.g., Sleepy Mountain inselberg)
iii) contain habitat essential for the survival of a significant portion of a migratory bird, terrestrial or marine or freshwater fish population?	yes	(e.g., snow geese staging areas, Porcupine caribou migration routes)
iv) contain outstanding examples of representative land or seascapes?	yes	(e.g., thermokarst coastline)
v) contain sites necessary for the preservation of genetic diversity?	yes	(e.g., wildfowl breeding sites)
vi) contain habitat essential for the preservation and enhancement of rare and endangered species?	yes	(e.g., peregrine falcon nesting sites)
vii) contain outstanding areas for public recreation and tourism?	yes	(wilderness area)

1. Jacques Cinq-Mars, National Museums of Canada: "At King Point there is a tremendous amount of very good and likely very important early historic information." (Cinq-Mars, 1983)

TABLE 4 Task Force on Northern Conservation

Management Guidelines as They Relate to the Northeast Yukon

Protected Area Guidelines	
i) does the candidate protected area contain values or features that would be adversely affected by human activity?	yes
ii) is the proposed area sufficiently large to ensure protection of the values at risk?	yes
iii) can several classes of protected area be incorporated within a single designated area?	yes
iv) are there alternative sites that would meet the objective of the proposed site?	not entirely[1]
v) has the candidate site been adequately inventoried prior to final establishment of boundaries?	yes
vi) will the protected area contribute to a continuation of traditional life styles, consistent with the maintenance of renewable resources?	yes
vii) does the proposal reflect the local sensitivities and interests respecting resource uses?	yes
viii) can the system be managed to promote a better understanding of conservation and to encourage research?	yes
ix) can private lands be protected areas to become part of the protected area network under private management?	not applicable[2]

x) can provision be made for periodic review of protected areas related to their creation, modification and management in order to ensure that the original objectives are being met?	yes[3]

1. There are snow goose staging areas which are outside the northeast Yukon, but protecting the staging areas is only one of the objectives of the protected area.

2. There are no private lands in the northeast Yukon.

3. The Inuvialuit Final Agreement calls for periodic review of issues related to the north Yukon.

4. Legislative Options

Any legislative option chosen to protect and manage the north Yukon must satisfy the following principles:

- it must be consistent with the intent and provisions of the land claims settlements relevant to the north Yukon and have the support of the native people, particularly the residents of Old Crow, Aklavik and Inuvik;

- it must accommodate the intent and provisions of the Porcupine Caribou Management Agreement;

- it must reflect the legitimate needs and aspirations of the people of Yukon and the constitutional development of the Yukon Territory;

- it must recognize the ecological integrity of the entire north Yukon and give conservation and protection of wildlife and habitat priority over development. Adequate protection for wildlife and habitat must be provided to ensure that the biological productivity of the north Yukon is maintained in perpetuity;

- it must make provision for limited development in the King Point area. Such development would be permitted only when the need is clear and only when the terms and conditions of the Inuvialuit Final Agreement are met; and

- it must meet the criteria required by the Man and the Biosphere International Co-ordinating Council for the establishment of a Biosphere Reserve.

There are three pieces of legislation available which could meet both development and conservation needs in the northeast Yukon and satisfy the above management principles. These are the National Parks Act, the Canada Wildlife Act and the Yukon Territorial Parks Ordinance. The advantages and disadvantages of establishing a national park, a national wildlife area and a territorial park are discussed below.

4.1 National Park

Advantages

Establishment of a national park which would encompass the entire north Yukon, as proposed by Berger, is the strongest option available to ensure the biological productivity of the region. Agreement among YTG, Parks Canada and DIAND on the future uses of King Point would be necessary prior to the establishment of a national park, including the size of the development zone, terms and conditions for development and construction of a transportation or utility corridor to the Dempster Highway. A King Point development zone would be best excluded from the park, but any support base built at King Point could also serve as an access point to the park, while the transportation corridor, if built, would be best

controlled if it was administered by Parks Canada. As noted earlier, increased access to the north Yukon is the most threatening aspect of development, but control by Parks Canada would be strict.

The Inuvialuit Final Agreement and the CYI Agreement in Principle call for a special resource management area in northeast Yukon; creation of a national park in this area would require the consent of the parties and amendment to the agreements. The fact that development at King Point could proceed and that land access to King Point would not necessarily be prohibited would soothe pro-development interests. Conservation values would be well protected by the national park status of the land. Joint management of the park by Parks Canada, YTG, the Inuvialuit and CYI would be encouraged.

Disadvantages

The former Conservative Government of Yukon made its position on the boundaries of the North Yukon National Park very clear and adamantly opposed eastward extension of the park beyond the Babbage River (John Crook, Land Management, DIAND, personal communication). Development interests see land access to the North Slope as a positive element in their drive to develop the resources of the north Yukon and to benefit from Beaufort oil and gas development (Dome et al., 1982; Government of Yukon, 1983a); however, industrial development is not permitted in a national park.

Pro-development interest in Yukon are strong, unemployment remains high and parks are generally seen by the public as preventing employment rather than encouraging it. In areas such as Yukon, where the economy has been largely dependent on non-renewable resource development, this perception is a powerful one. Although the current NDP government is likely to be more sympathetic to conservation interests than the previous government, it is unlikely to take major steps (which may prove politically unpopular) to promote more national parks in the near future, except within the context of the CYI claim.

DIAND support for the establishment of a national park which would encompass the entire north Yukon would be lukewarm at best, given its general support for development at King Point (Indian and Northern Affairs Canada, 1983d).

Biosphere reserves include a core area in association with adjacent similar areas where certain developments could proceed. The establishment of a national park across the entire north Yukon would largely preclude the "zone of co-operation". Instead, only the core area would be present.

The final disadvantage of establishing a national park to encompass the north Yukon is the recognition by Parks Canada that the entire area does not warrant national park status (Parks Canada, 1977).

Summary

The north Yukon would be best protected from industrial development through the establishment of a national park. However, it must be recognized that:

- while the area identified by Parks Canada in its 1978 proposal meets national park criteria, the entire north Yukon does not. Further, a national park encompassing the entire north Yukon would not be consistent with Biosphere Reserve criteria;

- there are resources in the northeast Yukon that can be developed without jeopardizing the wildlife and habitat. These resources are not limited to King Point;

- the Government of Yukon may not support significant eastward extension of the North Yukon National Park;

- DIAND will not support eastward extension of the Park in the face of Yukon opposition and would probably not support extension even if YTG was non-committal.

Establishment of the existing North Yukon National Park was difficult and although eastern boundary discussions have been promised, significant extension east of the Babbage River is unlikely. A national park extending across the entire north Yukon is a non-starter.

4.2 National Wildlife Area

Advantages

This option would see a national wildlife area administered by the Canadian Wildlife Service (CWS) established contiguous to the Northern Yukon National Park. CWS is an effective, experienced and widely respected organization that was established to carry out the conservation of wildlife and its habitat in the national interest. The Canada Wildlife Act provides for agreements with other parties (which could include YTG, the Inuvialuit and CYI) to involve them in the management of the wildlife area as well as in the management of migratory species. Such a co-operative management regime would permit controlled development within a strong conservation framework, would integrate land and wildlife management and would be responsible to the Minister of the Environment.

Non-conforming uses, for example a quarry and harbour development at King Point and a Dempster link, could be permitted in a national wildlife area, removing some of the concerns of YTG and DIAND. Other non-conforming uses might be permitted under very carefully controlled conditions, in accordance with national wildlife area management principles and the land claims agreements.

Establishment of a national wildlife area would be consistent with the intent of the Inuvialuit Final Agreement and the CYI Agreement in Principle. It would also be consistent with criteria for a Biosphere Reserve.

Disadvantages

Although National Wildlife Areas have an advantage over national parks in that they can be relatively easily and quickly established through Order in Council, they can be withdrawn from protective status by the same means.

YTG is likely to resist strongly any extension of federal control in the north Yukon as it would be contrary to the move toward provincial status. If the situation in the Polar Bear Pass wildlife area is any guide, DIAND would at least initially retain subsurface rights in the National Wildlife Area and would therefore play a major role in resource development decisions. Additionally, YTG could object to:

- management of north Yukon ultimately resting within the federal Department of the Environment;

- the fact that DOE (CWS) would strongly favour environmental protection over resource development. This could cause a number of problems in a territory with very high unemployment; and

- the likelihood that YTG would lose its absolute mandate to manage wildlife in the north Yukon.

Summary

Establishment of the northeast Yukon as a National Wildlife Area is a very attractive option because it would combine more management flexibility than is possible in a national park with very strong environmental protection measures. However, implementation of this option would require considerable negotiation on the part of YTG, CWS, DIAND and native organizations over the issue of land and wildlife management and would probably be perceived as a federal move to entrench conservation interests in the north Yukon. Considerable opposition from pro-development groups could be expected and it is unlikely that even a New Democratic YTG would be in a position to support the creation of a National Wildlife Area whereby the federal Minister of the Environment could be seen as having a veto over Yukon affairs and decisions. Unfortunately, therefore, establishment of a National Wildlife Area is probably impossible at present.

4.3. Territorial Wilderness Park

Advantages

Under the Yukon Territorial Parks Ordinance, a northeast Yukon territorial park could be zoned in a manner that would permit limited development like that proposed for King Point but would also protect the wilderness values of the region.

The Inuvialuit Final Agreement set a precedent for this alternative in the designation of Herschel Island, with the exception of the area around Pauline Cove, as a wilderness territorial park. Under the Agreement any proposed development in the Pauline Cove area is to be screened in

accordance with the environmental impact screening and review process set out in the Agreement and described here in Chapter Three. The historic resources of Pauline Cove are protected in a manner no less stringent than the regime of a national historic park. Development is governed by restrictions no less stringent than those in the Territorial Land Use Regulations.

YTG would welcome the transfer of land from DIAND and might be willing to accept certain limitations on the use of that land in return, including management by a wildlife board similar to those required by the Inuvialuit Final Agreement, the CYI Agreement in Principle, the Inuvialuit-CYI Overlap Agreement and the Porcupine Caribou Management Agreement. Wilderness protection in perpetuity could be further assured through amendments to the parks ordinance and through formal international recognition of the area as a biosphere reserve. Subsurface rights could be retained by DIAND or transferred to YTG, with appropriate development safeguards. Public consultation would be mandatory, as noted in the claims agreements.

The Renewable Resources Branch of the YTG is well respected by most conservation organizations and would presumably play a major role on behalf of the YTG in the administration of the park.

Finally, a territorial wilderness park adjacent to the North Yukon National Park would satisfy Biosphere Reserve requirements.

Disadvantages

There may be reluctance on the part of conservation interests and native groups to put control of a large part of the north Yukon in the hands of the YTG, given pro-development interests in Yukon and the corresponding attitude of the Yukon Conservative party, unless a number of restrictions on the powers of the government were put in place.

Native organizations may not agree that a territorial park is consistent with the intent of the land claims agreements or consistent with their own uses of the land, especially since a minister of the YTG would have the final say regarding development decisions.

The YTG may not be willing to accept restrictions in the exercise of its authority on what would be Commissioner's lands.

Summary

The establishment of a territorial wilderness park is the only option that clearly involves a transfer of land to Yukon and puts a minister of the YTG in the decision-making seat. Considerable negotiation would be required to determine what YTG would be willing to give in exchange. The area requires strict protection in perpetuity, with resource development taking very much a back seat to conservation. Whether the YTG would accept this notion or whether it would refuse to consider amendments to the appropriate sections of the Inuvialuit Final Agreement (Chapter Three) is something that cannot be determined at this stage. Nevertheless, with appropriate safeguards, the option could be acceptable

to conservation groups, native organizations and federal agencies. It is also the option that the YTG is most likely to support.

These safeguards would include:

- designation of the north Yukon as a Biosphere Reserve under UNESCO's Man and the Biosphere program. The vast majority of the territorial park would be zoned wilderness;

- establishment of a management philosophy equivalent to that of a national wildlife area;

- the formation of a territorial park management board with government and native representation on the board consistent with similar boards established by the Inuvialuit Final Agreement. Adjustment would be required to accommodate the final terms of a CYI settlement. Consideration should be given to designating the Wildlife Management Advisory Council (North Slope) as the territorial wilderness park management board;

- public participation in the planning process;

- surface and subsurface rights would be transferred to Yukon with the stipulation that exploitation of non-renewable resources would be prohibited except in the case of clearly defined national need and then only under conditions at least as restrictive as the National Wildlife Area Regulations, the Territorial Land Use Regulations, the Northern Inland Waters Act and Regulations and other relevant environmental protection legislation;

- the environmental screening and review procedures specified in the Inuvialuit Final Agreement would continue to apply to all development proposals.

The intent would be to ensure in perpetuity the protection of the wildlife and habitat of northeast Yukon, permit development at King Point under extremely stringent conditions, permit development of other resources when the need is clear and in the public interest and obtain community and YTG support for all of the above.

CHAPTER X

Conclusions

1. Overview

It would seem possible to reconcile the conflicting demands for northeast Yukon without preventing development outright and without destroying the existing wilderness values. It is argued here that the most effective way of protecting this area is by establishing the north Yukon as a biosphere reserve and by assigning formal protected status under the Yukon Territorial Parks Ordinance. The Inuvialuit Final Agreement and the CYI Agreement in Principle assign special significance to the north Yukon. Partial protection will be achieved by implementating the environmental screening and review processes outlined in these agreements. Nevertheless, formal protective status is required to protect more strongly the area in perpetuity from development-oriented interests, including - perhaps particularly - government.

The North Yukon National Park provides the strongest protection available for the northwest Yukon; an ecologically sensible eastern boundary for the park is the Babbage watershed excluding, for practical reasons, the Deep Creek tributary. Given that boundary, or one similar to it, the focus then clearly centres on the problem of reconciling development interests and conservation interests in northeast Yukon.

The following assumptions and considerations are relevant to the discussion:

- Some harbour development may occur at King Point within a decade.

- The degree of environmental protection offered northeast Yukon through the Inuvialuit Final Agreement and the CYI Agreement in Principle is inadequate for the long-term because the potential for project by project review independent of an overall plan remains ("destruction by insignificant increments"). The potential for conflict of interest problems also remains. There is still a need for formal and permanent protective status for northeast Yukon so that industrial development can be accommodated and contained in a way which will minimize environmental impacts.

- A formal management regime for northeast Yukon can be developed which would zone the vast majority of the area as wilderness in perpetuity. Development would be permitted only when the need is clearly proven and then only under extremely tight terms and conditions.

- Development at King Point can be managed in a manner that is environmentally acceptable and will not compromise the wilderness values of the surrounding area. (It should be noted that Deep Creek will be outside the national park and within the King Point

development area. Any degradation of Deep Creek water quality will be reflected in the lower Babbage, which is inside the park, and Phillips Bay.).

- The major conservation goal for northeast Yukon is the protection of wildlife - especially the Porcupine caribou herd, snow geese, moulting ducks and grizzly bears - and habitat. The major development goal is careful construction and operation of a King Point harbour and quarry. These objectives are not incompatible.

- The involvement and support of the native organizations is key to the success of any conservation regime established in northeast Yukon.

If development at King Point goes ahead, then the following steps must be taken to ensure that the cumulative environmental impact is minimized:

- review of the site selection criteria and the site selection process, including further examination of other sites (e.g., Sabine Point) to ensure that King Point is indeed the most suitable site from the perspectives of short term and long term multiple use, economics and, most important, environment;

- the full and meaningful participation of biologists in all phases of the development, from pre-design to abandonment;

- restriction of land use to the absolute minimum;

- restriction of access to a Dempster link, if built (and this is not recommended), to project personnel only;

- identification of all significant habitats prior to construction;

- design, construction and operation of facilities to avoid important habitats and to minimize impacts elsewhere;

- design, construction and operation of facilities in accordance with the limitations imposed by climate and the physical and biological environment;

- implementation of all proposed mitigative measures;

- constant monitoring of the impacts of all phases and aspects of the development. Research into areas not fully understood should proceed concurrently with development unless those data gaps are so significant that construction should be delayed until the research is complete. Examples of the latter would include geotechnical studies, studies of the hydrology of proposed water sources and studies of the importance of the King Point area to caribou. Examples of studies that could proceed concurrently with development are determination of the extent of the zone of disturbance and monitoring of impacts on individual species of wildlife; and

- immediate and effective implementation of the results of the research and monitoring programs in areas where these studies show that impacts can be further reduced.

Specific development details should include alignment of the airstrip to minimize over-land traffic and careful planning of facilities to allow for multi-purpose use and future expansion which will make the most efficient use of limited space.

Construction of a road to the Dempster is not recommended because of the difficulties in restricting access and minimizing related environmental impacts. A Dempster link would inevitably be viewed as "opening up the resources of the northeast Yukon" by pro-development interests, and pressure to use the road could increase to the point where politicians would be forced to comply. A winter road and resupply by sea should provide more than adequate freight capacity.

The mitigative measures identified in Chapter VII should be applied, and other measures subsequently identified should be implemented as required. The joint federal-territorial-native Wildlife Management Advisory Council (North Slope) required by section 12 (46) of the Inuvialuit Final Agreement must be established as soon as possible. In the event that development at King Point begins, the Council would ensure that the appropriate mitigative measures are applied, would assess the effectiveness of these measures and would recommend and implement necessary changes.

The land use planning process should be set in motion as soon as possible. A territorial wilderness park encompassing the northeast Yukon should be established immediately and the entire north Yukon should be submitted to UNESCO for consideration as a biosphere reserve. This would reinforce the identification of conservation as the predominant purpose of the region. Development at King Point could proceed in advance of the establishment of the territorial park and biosphere reserve, but only with the clear and unequivocal commitment by governments that the latter steps will be taken.

A Northeast Yukon Territorial Wilderness Park management board should be set up to manage the park. This board could be independent of the Wildlife Management Advisory Council (North Slope), but would be required to accept its recommendations. Consideration should be given to designating the Council as the wilderness park management board. Government and native group representation on the management board would be consistent with the Inuvialuit Final Agreement and the CYI Agreement in Principle. The board would recommend to YTG appropriate uses for the park and would receive input from the public through the land use planning process and, if separate from it, through the Wildlife Management Advisory Council (North Slope). Management of the North Yukon National Park, Herschel Island Territorial Park and the Northeast Yukon Territorial Wilderness Park would be closely co-ordinated.

2. Summary

Construction of a harbour and quarry at King Point is not recommended at this time. Such a development should proceed only under strict environmental terms and conditions, within the context of a conservation-oriented management framework, and this framework is not yet in place. When it is in place, then proposals for harbour and quarry development could be considered, for it appears that this type of development can be undertaken without harming the surrounding wilderness.

The environmental terms and conditions that must be attached to project approvals have been outlined earlier and should serve to minimize impacts. Continuous monitoring will identify problem areas, and the required corrections can be made before irreversible damage is done. However, the conservation framework within which development at King Point is permitted to proceed is even more crucial to the future of north Yukon than the terms and conditions attached to any one project.

The wilderness of north Yukon is far from secure. The northwest Yukon is now a national park, but virtually all wildlife that uses the area is migratory. Caribou calve in northwest Yukon and adjacent areas of Alaska. Snow geese stage in several areas of the north Yukon; other geese, ducks, swans, many raptors, all passerines and bowhead and beluga whales frequent the lakes, rivers and coastal areas. All but gyrfalcons winter in areas outside the protection of the national park, and all are vulnerable to the pressures of development. So are species which winter in the park but move across park boundaries - grizzlies, wolves, polar bear. The well-being of the entire north Yukon ecosystem cannot be assured by the presence of a national park and an environmental screening and review process. The fact that the entire Babbage River drainage system is not inside park boundaries points out clearly the need for comprehensive environmental management for the entire north Yukon. Development pressures may continue to build. Commercial oil and gas reserves may be discovered and developed. Economic mineral deposits in north Yukon may be identified. And a port may be built at King Point, providing a door to the wilderness.

Some forms of development may be compatible with wilderness. Most are not and must be prevented if the wilderness is to survive. In north Yukon, there is still time to establish a conservation framework that will guarantee the survival of the wilderness forever, time before development pressures become overwhelming, time before one of the last remaining areas of wilderness on the planet is lost.

APPENDIX 1

Chronology of Events Related to Development at King Point

December 6, 1960: The Arctic National Wildlife Range (ANWR) in northeastern Alaska was established by the U.S. Department of the Interior (figure 4).

October 21 and 22, 1970: The Arctic International Wildlife Range Conference was held in Whitehorse to study a proposal (Thompson, 1970) to establish a Yukon wildlife range adjoining the Arctic National Wildlife Range in Alaska. Thompson proposed the designation of the north Yukon as a National Wildlife Range (figure 4) to be managed by the Canadian Wildlife Service (CWS). The suggested management regime was to be flexible enough to accommodate hydrocarbon and mineral development but at the same time provide real protection to the wildlife and the wilderness in perpetuity.

Thompson suggested that since the formal establishment of a National Wildlife Range could take some time, immediate withdrawal of the area under the Territorial Lands Act should be considered as an interim measure. Appropriate application of the Land Use Regulations could then permit zoning of the area in a manner which would prohibit land use operations except under terms and conditions intended to protect wildlife and habitat. At the same time, the Yukon Department of Game could act through the provisions of the Yukon Game Ordinance to accomplish the wildlife management aims of the CWS until the CWS could take a direct management role. Traditional uses by native peoples would be permitted and natives would be encouraged to participate fully in the management of the region.

The Conference endorsed Thompson's proposals and the recommendations of the Conference were in turn endorsed by Jean Chrétien, then Minister of Indian Affairs and Northern Development.

1971: Public Works Canada released a report entitled "Herschel Island - Feasibility of a Marine Terminal". This study examined four potential deep draft harbour sites in the Canadian Beaufort and concluded that, "Babbage Bight, about 20 miles southeast of Herschel Basin, is considered the most favourable location for a deep-water marine oil terminal in Mackenzie Bay. An installation at this site, including marine elements and onshore support facilities, would be

technically feasible" (page iv). The authors defined the Babbage Bight as the area between King Point and Kay Point and regarded the Mackenzie Bay area east of King Point as unacceptable because of water depth restrictions. No particular site in Babbage Bight was identified as superior.

March 21, 1974: Canadian Arctic Gas Pipelines Ltd. (CAGPL) submitted to DIAND an application for the granting of a gas pipeline right-of-way across the north Yukon and Northwest Territories to transport natural gas from Prudhoe Bay and the Mackenzie Delta to southern markets in the United States and Canada. Also on March 21, 1974, the proposal was referred to Mr. Justice T.R. Berger for examination by public hearings.

April, 1977: In his report on the Mackenzie Valley Pipeline Inquiry (Berger, 1977) Mr. Justice Berger proposed a wilderness park that would cover approximately the same area as that proposed by the Arctic International Range Conference (figure 3) and that would totally and permanently exclude any form of industrial development. Together with the adjoining 3.6 million hectare ANWR in Alaska the resulting 7.2 million hectare wildlife range would have been one of the largest wilderness areas in the world, large enough to ensure the well-being of its wildlife, especially the Porcupine caribou herd and the snow geese. Berger noted that construction of a pipeline across the north Yukon as proposed by CAGPL would not only destroy the possibility of establishing a true wilderness park and very seriously endanger the Porcupine caribou herd but would have undermined efforts in the U.S. to convert the Arctic National Wildlife Range to wilderness status.

In this context, Berger's principal recommendations were:

- Lands for a wilderness park in the northern Yukon should be withdrawn immediately under section 19(c) of the Territorial Lands Act and subsequently a wilderness national park should be created under the National Parks Act. The establishment of an international wilderness park in the northern Yukon and northeastern Alaska should be pursued through discussions between Canada and the United States.

- Wilderness protection should be afforded the area of west Mackenzie Bay to protect the calving grounds of the beluga.

Justice Berger also insisted that the rights of native people to live, hunt, trap and fish within the park and to take caribou within its boundaries, be guaranteed from the outset. Natives from Old Crow, Fort McPherson and Aklavik use the area within the proposed boundaries and the people of Old Crow, in particular, would play an important role in the management of the park and of the Porcupine caribou herd.

June, 1977: The National Energy Board (NEB) rejected CAGPL's proposal to build a gas pipeline across the North Slope from Prudhoe Bay to the Mackenzie Delta for many of the environmental reasons noted by Berger and also cited incompatible time constraints. CAGPL had indicated the urgent need to connect Alaskan gas to mainland U.S. markets, but the NEB was not convinced that adequate time was available to resolve serious socio-economic concerns before construction of the pipeline began along the Mackenzie Valley. The North Slope coastal route proposed by CAGPL was considered environmentally unacceptable by the Board, as was the cross-delta section of that route. CAGPL had also proposed an interior route which would skirt the environmentally sensitive Old Crow Flats and pass near the socially sensitive village of Old Crow which was adamantly opposed to the pipeline. The Board found the interior route to be both socio-economically and environmentally unacceptable.

1977: A Northern Yukon Conservation Planning Task Force was established by the federal government in 1977 to "identify the manner in which a National Park and other conservation mechanisms could be established so that they could exist in the most complementary way in the context of other identified interests" in the north Yukon. The Task Force examined six options for a north Yukon management regime: no action; special land management zone under the Territorial Lands Act; Canada Wildlife Area; National Wilderness Park; combined National Wilderness Park/Canada Wildlife Area (proposed by the Canadian Wildlife Service; figure 7); and interim withdrawal under the Territorial Lands Act. In late 1977, the Task Force recommended interim withdrawal pending further studies, consultation and land claims negotiations. The remaining five options were rated in terms of flexibility (multiple use), rapidity of implementation and level of preservation, as follows:

Flexibility for Multiple Use	Ease of Implementation	Preservation
(Expressed in descending order)		
No Action	No Action	Wilderness Park
Special Zone	Wildlife Area	Combination *
Wildlife Area	Special Zone	Wildlife Area *
Combination	Combination	Special Zone
Wilderness Park	Wilderness Park	No Action

* Allows for a measure of conservation to be applied to the Yukon south of the Porcupine and Bell rivers through a CWS/YTG agreement.

(Option 6 (withdrawal) was not rated as it was regarded as a temporary measure.)

1977: The Advisory Committee on Northern Development released its report, "Western Arctic Moderate Draft Harbour", in which available information for 16 potential harbour sites along the entire Canadian Beaufort Sea coast was reviewed. While the Committee felt that Tuktoyaktuk was well sited for many reasons, channel dredging costs for a moderate draft harbour (6 m water depth) would be very high and sites other than Tuk could provide adequate harbours at lower cost. Included as one of the most likely alternatives was King Point, and the Committee recommended that government prepare a detailed environmental impact study for that area.

July 6, 1978: On July 6, 1978 Hugh Faulkner, then Minister of Indian Affairs and Northern Development announced the withdrawal of 3.8 million hectares of the north Yukon from new development (figure 3). The area withdrawn was essentially the same area recommended by Justice Berger for national wilderness park status. At the same time, Mr. Faulkner announced the formation of the Northern Yukon Task Force to develop a management plan for the Canadian portion of the range of the Porcupine caribou herd and to co-ordinate various working groups on northern land use planning and management.

Mr. Faulkner noted that the conservation values of the land north of the Porcupine and Bell rivers exceeded the development potential and for that reason all the land was withdrawn to allow the government to determine how much of the area should be dedicated to a national wilderness park and to other conservation purposes.

The land withdrawal under the Territorial Lands Act stopped further disposition of land for oil and gas exploration, ended the sale or lease of surface rights and prohibited entry for staking of mineral claims previously permitted under the Yukon Quartz and Placer Mining Acts. Existing mineral claims and oil and gas interests were not affected, and exploration on such properties can proceed under normal government regulatory controls. Pauline Cove on Herschel Island was excluded from the land withdrawal, as was a small area around Old Crow. (It should be noted that at this time Parks Canada was a part of the Department of Indian Affairs and Northern Development.)

Late 1978:

In late 1978, Parks Canada proposed the establishment of a national park in the northwest Yukon (figure 6). The "area of interest" defined by Parks Canada encompassed about 5.2 million hectares, including Herschel Island, and the eastern boundary was drawn to include King Point within the park. Although the proposal included many archaeological sites, critical migratory bird habitat and the Porcupine caribou calving grounds, it divided the north Yukon vertically and split the North Slope ecosystem.

Parks Canada indicated that four principles would be followed:

- the area set aside as a national park would be used on the terms of the land. Visitors would be expected to be self reliant and support services would be outside the park;

- intensive use or development zones would not be permitted in the park;

- traditional hunting, fishing and trapping would continue; and,

- a joint management regime would be developed between Parks Canada and the native people to ensure a continuing role for native people in managing the wildlife resources.

October 31, 1978:

The Inuvialuit Land Rights Settlement Agreement in Principle was signed on October 31, 1978. Among other things, the federal government agreed to establish a national wilderness park of at least 3.2 million hectares of traditional Inuvialuit lands and further agreed to further consider the strong recommendation of the Inuvialuit that the government act upon Mr. Justice Berger's recommendation that all the land north of the Porcupine and Bell rivers be

dedicated as a national wilderness area. Traditional land use in the park and on other lands in the Yukon Territory would be guaranteed to natives of the Yukon and Northwest Territories who could demonstrate traditional use in those areas. Basic to the Agreement in Principle was the protection and preservation of the wildlife, the environment and biological productivity through the application of conservation principles and practices.

1979: In 1979 the Canadian Wildlife Service proposed the establishment of a National Wildlife Area in the northwest NWT and the area of the north Yukon not required for a national park. The objectives of the National Wildlife Area would be:

- to protect major international wildlife populations and habitats from damage by human activities;

- to conserve the wildlife resource base of the native Dene and Inuvialuit peoples;

- to control disturbance by human activity of wildlife populations and habitats; and,

- to meet Canada's obligations in the conservation of national and internationally shared wildlife populations.

CWS suggested that successful management would require close co-operation among the Dene and Inuvialuit who use the area, the Yukon Territorial Government (YTG), the Government of the Northwest Territories and the CWS. Traditional hunting and fishing rights within the limits of sustainable yields would be accommodated, and no land uses that would endanger wildlife or its habitat or damage the cultural values of the area would be permitted.

1979: A National Wilderness Park Steering Committee was established pursuant to the Inuvialuit Agreement in Principle and was to consist of representatives from YTG (one), the Inuvialuit (two), Old Crow (two), the Department of the Environment (DOE) (one) and the Dene (one). Despite YTG opposition (YTG adamantly opposed the Agreement in Principle and boycotted the Committee) the other members of the Committee prepared and submitted an interim report to the Ministers of DIAND and DOE and recommended that the north Yukon withdrawal under the Territorial Lands Act be replaced with an interim withdrawal under the Canada Wildlife Act. The Canada Wildlife Act was seen to offer superior protection for the wildlife of

the region, particularly in the area of management of both land and wildlife. The Territorial Lands Act does not apply to wildlife management; in the withdrawn area, the Yukon Game Ordinance applies to game only and the Territorial Lands Act to the land only. The Committee recommended that the ultimate designation of the withdrawn area be finalized through land claims settlement legislation for the Council for Yukon Indians and Inuvialuit.

In an appendix to the interim report, DOE proposed the establishment of a national park in the northwestern Yukon and a national wildlife area in the remainder of the withdrawn area not occupied by a national park (figure 8). The DOE proposal was essentially a combination of the separate Parks Canada and CWS proposals. DOE argued that the combined application of the National Parks Act and the Canada Wildlife Act would provide the strictest possible protection for highly sensitive areas (the national park) and a greater degree of flexibility for wildlife and resource management in other areas (the national wildlife area) where conservation principles would guide and restrict development. As both acts fall under the same Minister it was felt there would be a greater likelihood of consistent, comprehensive and complementary management for the entire area and that traditional uses of the land and its resources would be guaranteed.

1979: Dome Petroleum examined nine potential medium and deep draft harbour sites along the Canadian Beaufort Sea coast and concluded that King Point offered the greatest potential for a deep draft hydrocarbon development and production support base (Dome, 1979).

Dome chose King Point as its preferred site for a deep draft harbour (figure 11) for a number of reasons, including:

Marine Factors

- proximity to potential oil and gas production sites;
- proximity to deep water (the 25 m water depth contour lies only a few kilometres offshore);
- easy access by Mackenzie River barge;
- overwintering protection to vessels offered by a wide band of shorefast ice;
- vessel breakout in spring is facilitated by the narrow band of shorefast ice and early breakup;
- vessels of 15 m draft or less could be harboured and drydocked with some modification of the lagoon and construction of breakwaters.

Onshore Factors

- adequate stable and level land adjacent to King Point for facility infrastructure and airstrip construction;
- adequate gravel resources within 10 km of King Point (53 million cubic metres);
- nearby granite deposits for rip-rap for artificial island, pier and breakwater construction;
- proximity to Inuvik (140 km) and Fort MacPherson (220 km) would make winter and all-weather road construction (the latter to Ft. MacPherson only) feasible.

A two-stage development was proposed for King Point:

i) Short Term

King Point could be used for alternate winter mooring of Canmar vessels, vessel refueling and resupply in the short term. A 1200 m STOL strip, 4 hectare camp, staging area, tank farm, an 800 m pier and associated access roads would be constructed to support these activities.

Dredging could be undertaken to construct a channel through the northwest end of the barrier bar and a 6 m deep mooring basin inside the lagoon. Deeper draft harbour development would be focused offshore in the lee of the pier/breakwater which would extend about 800 m from the headland to the 10 m contour. A one square km mooring basin could be dredged as shown in figure 11, or the pier/breakwater could be extended slightly to provide a mooring basin without dredging.

A tank farm could be constructed at the northwestern headland with a fuel line extending to and along the breakwater, and borrow pits and access roads would be constructed as required.

ii) Long Term

Dome forecast that the long term use of King Point could include:

- year-round fueling for all deep draft vessels requiring 10 m and deeper water;
- staging for year-round drilling operations;
- storage of material from both sea lift and Mackenzie River barge traffic;
- a drydock facility;

- year-round accommodation for administrative, operational and support staff;
- a deep draft harbour for maintenance of large icebreakers and possibly oil tankers;
- an assembly and staging site for production facilities;
- a transfer point for quarry material as required for construction of permanent facilities, including artificial islands;
- an oil and gas terminal for pipeline and tanker transportation modes.

The long-term facility would include a 3600 metre jet strip (through lengthening the STOL strip), a 10 hectare camp, warehousing and staging area and a large tank farm. The pier/breakwater could be extended to the 20 m isobath (2200 metres from shore) and a deep mooring basin could be dredged in the lee of the breakwater. A floating drydock could be located in the mooring basin.

Further development of the harbour could include construction of an additional breakwater southeast of the pier/breakwater to provide more ice and weather protection.

October 1980:

In October 1980, the YTG presented its "Northern Yukon Resource Management Model" in which it outlined plans to balance wildlife conservation and environmental protection with future land based industrial development in the north Yukon, particularly along the Beaufort Sea coastline. YTG clearly indicated its very strong opposition to the Inuvialuit Agreement in Principle. The management regime proposed by the YTG purported to be "the only logical alternative that will accommodate the needs and requirements of Canada" given the perceived major resource/land use conflicts in the north Yukon. The proposal divided the north Yukon into four resource management zones: the northwest portion; Herschel Island; the central and northeast portion; and the southern portion (figure 16).

(i) Zone "A" - Northwest Portion - National Park

YTG recommended the immediate establishment of a national park in the area west of the Babbage River and north of the watershed. The eastern boundary would have been defined by a proposed Northern Yukon Resource Management Advisory Committee, and further research would define a marine component to the park.

The main purpose of the park would be to protect the Porcupine caribou calving grounds. No special

conditions would be applied to the park other than that only controlled scientific and resource management uses would be permitted during the calving period, and the Park would be established under the existing National Parks Act. The Northern Yukon Resource Management Committee would effect co-ordinated zone wildlife management.

(ii) Zone "B" Herschel Island - Territorial Historic Park

Given the historical and archaeological significance of Herschel Island, the YTG proposed that it immediately be given Territorial Historic Park status. Pauline Cove could be used as an over-wintering harbour by industry, and existing historical buildings could be used as a joint National Park/Territorial Park headquarters. In addition a Polar Continental Shelf Project supply base would be considered, "controlled and possibly interpreted as approximately historical activities".

(iii) Zone "C" Central and Northeastern Portion - Special Resource Management Zone.

This zone contains a variety of resources, land uses and potential developments which would require, in the view of the YTG, an integrated resource use management approach. The section of the coastline between Kay Point and Shingle Point, particularly King Point, was identified as the most suitable area for a deep water port, transportation and pipeline corridors and other sites such as gravel quarries that would facilitate Beaufort Sea developments.

YTG proposed the immediate creation of the Special Resource Management Zone and recommended that the Northern Yukon Resource Management Advisory Committee initiate the preparation of a land/resource use plan for this zone, advise ministers with respect to the implementation of the management regime, monitor resource management activities, initiate required studies and inventories and advise about required adjustments to the management regime. The resource management regime would accommodate a variety of users and simultaneously provide those measures required for the protection and conservation of wildlife and the environment.

The Northern Yukon Resource Management Advisory Committee would advise the Minister of DIAND and the Yukon Minister of Renewable Resources on the best use of the natural resources of the north Yukon. In particular, the Committee would advise on: land use;

specific details of the resource management model; a land/resource use plan for Zone "C"; annual review of the resource management plan; and a process that would provide for public participation in the development and adjustment of the management regime. The Committee would be made up of a chairman appointed by the Yukon Minister of Renewable Resources and one member each from DIAND, Fisheries and Oceans, Energy, Mines and Resources, DOE, YTG - Renewable Resources, YTG - Economic Development and Tourism, COPE, Old Crow Band Council, Old Crow Hunters and Trappers Association, and North Slope Inuvialuit Hunters and Trappers Association.

(iv) Zone "D" Southern Portion - Possible Resource Management Extension

Zone "D" is not discussed in the YTG's resource management model beyond being noted on the map (figure 14) as a possible extension of Zone "C". Zone "D" is the area between the Porcupine and Bell Rivers and the northern watershed and is not known to be particularly rich in non-renewable resources. On the other hand, it is particularly rich in renewable resources. It would appear that the YTG was simply reducing the amount of land it was prepared to devote to a wildlife reserve or park to the minimum and intended to keep its options open in all other areas.

November, 1980:

In a document entitled, "Rationale for the Transportation Corridors and Development Zones of the Interim Land Use Plan for the Beaufort Portion of the Western Arctic Region", Dome Petroleum Ltd. identified two "development zones" on the Yukon coast based on a number of factors, including distance from oil, gas production, potential uses, terrain characteristics, distance to deep water, possible utilization as a harbour and potential environmental effects of the proposed development. One of these zones was a Herschel Island Development Zone; the other was a King Point Development Zone.

The King Point area was identified as a major focal point for land, air and marine transport. About 70 square kilometres would be used for development, including a year-round deep water harbour, an oil and gas terminal with processing and storage facilities and possible LNG facilities.

King Point would serve as a major operations centre for Dome's Beaufort activities. Included in the harbour facility would be dry docks, a fuelling depot, supply base and staging facility. Nearby sand and gravel sources were identified.

Dome identified two transportation corridors (Herschel-King Point and King Point-Dempster Highway) and indicated that transportation corridors would be about 4 kilometers wide and would include rights-of-way for pipelines, roads and power lines. The corridors were intended primarily for pipeline facilities but roads would of course be present and would range in application from year-round to winter use only.

(i) Herschel Island to King Point Corridor

The transportation corridor would cross the Yukon North Slope, approximating the coastal route of the rejected CAGPL proposal. Pipelines would connect onshore oil and gas facilities at Herschel Island with processing, storage and pipeline facilities at King Point. The corridor would also include an all-weather road.

(ii) King Point to Thunder River Junction Corridor

The transportation corridor from King Point to the Dempster Highway would include oil and gas pipelines and an all-weather road.

January, 1981: In January 1981, U.S. President Carter signed into law the Alaska National Interest Lands Conservation Act, a version of which was first passed by the House of Representatives in 1978. The Act designates the entire central Brooks Range as the Gates of the Arctic National Park and Preserve and made significant additions to the Arctic National Wildlife Refuge, most of which is now formally designated a wilderness area.

1982: In Volume 2 ("Development Systems") of the "Environmental Impact Statement for Hydrocarbon Development in the Beaufort Sea - Mackenzie Delta Region", Dome, Esso and Gulf described a potential deep draft harbour development for King Point (figure 12). The profile is similar to that proposed by Dome in 1979 and the proponents noted that construction details would be dependent on a number of factors, including the location, size and timing of commercial discoveries, the chosen hydrocarbon transportation mode and the regulatory requirements of government and the Inuvialuit.

The proponents estimated that a fully developed shorebase could have a population in excess of 500, that year-round operation would be likely and that major activities could include drydock refitting, gravel crushing, concrete manufacturing, steel

fabrication and major assembly operations. Up to 75 hectares could eventually be required for buildings and infrastructure, roads, storage and an airstrip.

July, 1982: Gulf Canada presented to the federal government its proposal to build a temporary hydrocarbon exploration support base at Stokes Point. Gulf intended to use existing facilities at the former DEW Line site and to install new facilities, including warehouses, accommodation buildings and a pier and breakwater, as required. Total costs were estimated at about $63 million. In its site selection process, Gulf examined a number of locations along the Beaufort coast from Herschel Island to the Parry Peninsula and concluded that Stokes Point offered the greatest advantages in a number of areas. These areas included: protection from ice encroachment; existing facilities; storm protection; proximity to operations; dredging requirements; and overall cost effectiveness. King Point was ruled out primarily because of the exposure of the site to storms and ice incursions and because of much higher overall development costs. However, Gulf clearly recognized that King Point would offer definite advantages if a deep draft harbour should become necessary in the long term, and rated the site a close second to Stoke Point for satisfying Gulf's short-term needs.

March 16, 1983: Indian and Northern Affairs Canada issued a report entitled, "Facilities Siting: Beaufort Sea Shorezone Study" (Indian and Northern Affairs Canada, 1983b) following an interdepartmental review of ten possible sites for port facilities along the Beaufort coast - nine shorebases and a floating base in Herschel Basin. The study was based on a review of the needs of the major oil and gas operators in the Beaufort, a review of several earlier studies conducted to identify potential harbour sites and a limited environmental and logistical analysis of the ten most likely alternatives. The study was not intended to be a comprehensive facilities planning exercise but was instead an overview. No new data was generated and no sites that had not been previously identified, with the exception of a "floating base" option, were examined. The study concluded that, based on existing and short term future needs, Stokes Point offered the greatest advantages, but that "if in the longer term deeper draft vessels come into use in Mackenzie Bay and a new support base is required, King Point offers the more suitable location."

July 1983: Peter Kiewit Sons Co. Ltd. proposed to the federal government the construction and operation of a

sandstone quarry about 14 km south of King Point, a harbour facility at King Point (figure 13) and an all-weather road linking the two. Kiewit suggested that markets for quarry rock would be available initially in the U.S. Beaufort and subsequently in the Canadian Beaufort and that early start-up would be essential to ensuring the success of their venture. The operation was to be summer season only, and shipments of rock would be limited to the open-water period.

King Point was chosen by Kiewit as the harbour site for a number of reasons, including:

- moderate distance from the proposed quarry site;
- haul road routing could avoid most problems of ice-rich and patterned ground;
- longer ice-free conditions to possible Canadian Beaufort markets than at Stokes Point; and
- the shoreline is considerably more stable than the Sabine Point site and there is more than enough low land next to the sea for construction of necessary quarry and port facilities.

Briefly, the major features of the Kiewit proposal are:

i) King Point Camp

- a 62 hectare site, including a 1200 metre runway, a tank farm holding 11.25 million litres of fuel, a settling pond, a 300-400 person camp and a maintenance and repair shop;
- access road to freshwater lake, airport, haul road and within the camp itself;
- air traffic volumes of 2 to 3 aircraft per day during the active shipping season;
- mechanical sewage treatment plant; and
- portable generators for camp and shop power.

ii) Load Out Dock and Stockpile Area

- stockpile area capable of handling up to 500,000 tonnes of quarry rock and seasonal stockpiling of 200,000 - 500,000 tonnes of rock;
- conveying equipment to load barges and self-loading vessels and equipment to feed the conveyors;
- a 400 m long, 20 to 40 m wide breakwater/pier (to the 8 m depth contour);
- minimum harbour depth of 6 m for the rock barges and a dredged 12 m channel to the seaward end of the breakwater/pier for docking bulk carriers;

- vessel traffic of about three barges/week over the 60-day shipping season during the first year and up to 8 vessels/week during subsequent years;
- facility designed to ship 1 X 10^6 tonnes in the first season and a maximum of 2 X 10^6 tonnes/year in subsequent seasons.

iii) Haul Road

- 1.7 m gravel pad, 18-23 m wide with 3 metre wide, 1 metre thick berms on both sides;
- total length about 20 km (shoreline to quarry site);
- haul vehicles: 85 ton bottom dump tractors pulling 2 trailers for a 250 ton total capacity; 150 ton end dump trucks (15 bottom dump units and 10 end dump units in all);
- 40 m span bridge at Deep Creek and culverts in other drainage channels;
- vehicle traffic: normal conditions - 15 one-way trips/hour; peak conditions - 20 one-way trips/hour. In addition there would be a certain amount of traffic from small supervisory vehicles, haul road maintenance equipment, water trucks, etc.

iv) Quarry

- quarry area would be developed from the northeast portion of the property to the south. Waste material would be discarded along the northern and eastern boundary of the quarry excavation;
- bench and box cut quarrying operation;
- blasting requirement about 1/2 kilo powder/m^3. Blasting about once/day during the main production season;
- 20 cubic yard front shovel and 10 cubic yard front end type loading equipment;
- rock crusher to reduce rock to about 12 cm maximum diameter. Rip-rap sorted and moved separately;
- machine shop;
- powder magazine;
- weir and settling pond;
- total area of quarry: 4 km by 2 km; and
- ancillary equipment: rotary and percussion drills, water trucks, powder trucks, mechanics' trucks, service trucks, fuel trucks, cranes and fire trucks and smaller vans and pickups for personnel transportation.

July 1983: In response to the proposals put forward by Gulf Canada and Kiewit and the controversy generated as a result, John Munro, then Minister of DIAND, established the North Slope Project Review Group to prepare "recommendations concerning the need, establishment and suitable location of shore and harbour facilities on the North Slope of Yukon". The Review Group was composed of three members from YTG, two from CYI, two from COPE and a non-voting chairman from DIAND. The Review Group was unable to agree upon a common set of recommendations and on October 17, 1983, presented two sets of recommendations to Mr. Munro. COPE and CYI rejected any need for development on the North Slope in the short term but suggested that King Point would be a likely choice for a future permanent port facility. YTG felt that both the Stokes Point and King Point proposals were viable and should be supported, subject to appropriate environmental and socio-economic terms and conditions. The chairman indicated that, if pressed, he would side with the COPE and CYI representatives.

November 7, 1983: Mr. Munro announced that neither the Kiewit proposal nor the Gulf Canada proposal would be approved "for the time being" because consensus on a comprehensive package for the North Slope had not been reached and because land claims negotiations were in a sensitive stage and could be jeopardized if either or both projects were approved. The comprehensive package of interrelated issues Mr. Munro referred to included: progress on outstanding land claims with CYI and COPE; consensus on the boundaries for a proposed national park; creation of a Porcupine caribou management board; implementation of land use planning; substantive agreement on where to focus industrial activities so as to minimize environmental disturbances; and the verification of potential economic benefits. Mr. Munro also indicated that development of Stokes Point would be inconsistent with national park philosophy and that King Point was a more desirable site for a port facility.

December, 1983: The Beaufort Environmental Assessment Review Panel held hearings in Whitehorse in early December to discuss, among other things, industry proposals for development along the North Slope. As examination of hydrocarbon exploration in the Beaufort was outside the Panel's mandate, discussion of port facilities focused primarily on the use of King Point as a support base for development and production activities. Various positions were put forward by the participants at the hearing ranging from full support for the proponents' plans to total opposition

to any development on the North Slope. However, there did appear to be some consensus that King Point could be a logical and acceptable site for a permanent, deep-draft facility should the need for such a development be proven.

April 17, 1984: On April 17, 1984, the federal Cabinet approved an Agreement in Principle between Canada and the Council for Yukon Indians. The terms of the Agreement in Principle set the framework for development in the North Yukon south of the watershed. (COPE and CYI also negotiated an overlap agreement which addresses issues which concern both groups, including the environmental impact assessment process for the north Yukon.)

June 5, 1984: On June 5, 1984, a final land claims agreement between Canada and the Inuvialuit of the western Arctic was signed in Tuktoyaktuk by representatives of all concerned parties. The terms of the Final Agreement regarding the establishment of the North Yukon National Park and an environmental screening and review process for the northeast Yukon outside the national park are discussed in Chapter Three. At present the eastern boundary of the national park is the eastern bank of the Babbage River and therefore King Point is excluded, although there is a commitment to further discussions on the eastern boundary among the people of Old Crow, the CYI, the Inuvialuit, DIAND, Parks Canada and YTG. These discussions would take place under the umbrella of land use planning and could result in some eastward extension of the national park.

The Final Agreement was given legal effect by the proclamation of the Western Arctic (Inuvialuit) Claims Settlement Act on July 25, 1984.

July 31, 1984: The Beaufort Environmental Assessment Review Panel released its report on the environmental and socio-economic implications of oil and gas development in the Beaufort Sea - Mackenzie Delta region on July 31, 1984. The Panel recommended, among other things, that no port development be permitted west of Kay Point on the Yukon coast and that a road link from a Yukon port to the Dempster Highway be built only if access could be strictly controlled.

1985: In 1985, Monenco Limited and Interlog Consultants Limited formally applied to DIAND for permission to construct and operate a commercial multi-user, multi-purpose deep draft port to be open year-round at King Point. The consortium would plan, design,

construct, manage and operate the facility and indicated that private financing would be available for the estimated $100 million start-up costs.

Monenco and Interlog saw development proceeding in four phases:

i) exploration support base;
ii) international port;
iii) Beaufort Sea hydrocarbon production service centre; and
iv) further expansion as necessary.

All present and future requirements would be accommodated within an 8 km by 8 km onshore development zone and an offshore facility which would include protective berms, a dredged channel and mooring basin and loading docks (figure 14). Services and facilities the project would offer include:

- a four berth harbour, a 12m deep, 1/2 km by 1/2 km mooring basin and a 12m deep access channel;
- warehousing and staging areas;
- bulk cargo handling equipment;
- 1800m runway;
- helicopter pad;
- airport infrastructure including hanger, terminal, maintenance facilities, and navigation aids;
- fuel depot;
- steel fabrication facilities;
- meteorological, communication, search and rescue and ice forecasting services;
- administration services;
- community services; and
- accommodation for about 300 resident and 150 transient personnel.

Detailed site studies and planning have not been carried out and a detailed timetable is not available.

The proponents suggested that potential users of such a facility would include the oil and gas industry in both the Canadian and U.S. portions of the Beaufort Sea, government agencies including National Defence and Coast Guard, oil and gas service industries and native corporations.

APPENDIX 2

The Environment of the King Point Region

1.0 Climate

King Point lies in a polar maritime climate zone, where the winters are long, cold and dark and the summers short, cool and foggy, with nearly continuous daylight. Widespread fog, particularly prevalent in late summer, noticeably reduces the amount of insulation and reinforces the already low rate of evapotranspiration. In summer, the influence of low water temperatures offshore and the proximity to pack ice results in generally low temperatures. In winter, the largely ice-covered Beaufort exerts a slight moderating effect on coastal temperatures.

There is no meteorological station at King Point; however, the DEW line site at Shingle Point is less than 40 km to the southeast and is subject to similar weather (Parker and Alexander, 1983). Data from this site has been used in the following discussion: Tables 5 and 6 and figure 23 provide a summary.

1.1 Temperature

The mean annual temperature at Shingle Point is -10.1°C; February is the coldest month, with a mean daily temperature of -27.3°C and July is the warmest month with a mean daily temperature of 10.6°C. It should be noted that temperatures near -45°C occur nearly every winter in the area, and temperatures over 20°C occur most summers. For example, the record high for August is 30.1°C, recorded in 1979 while the record low for February is -52.2°C, recorded in 1968 (Atmospheric Environment Service, 1985; Table 5).

King Point has an annual average of 40 frost-free days; mean date of last frost is June 25 and mean date of first frost is August 10 (Burns, 1973).

1.2 Precipitation

Total annual precipitation is low - about 13 cm annually - because of the predominance of cold, dry arctic air masses (Table 5). Precipitation in summer usually peaks during July and August and most often occurs as weak showers, although heavy frontal downpours associated with convective clouds and slow moving cyclonic systems do occur. Snow falls are most frequent in October and March through April, and most snowstorms last less than 24 hours. The heaviest snowfalls are in October, a result of cyclonic activity and enhanced convective snow shower activity as cold arctic air moves across areas of open water. There is a rapid decrease in snowfall amounts once freeze-up occurs (Neil Parker, Environment Canada, personal communication) although snow can and does fall at any time. Freezing rain occurs most frequently during May and October.

Table 5 SUMMARY OF CLIMATE DATA (EXCLUDING WIND DATA) FOR SHINGLE POINT, YUKON

(a) Monthly average and extreme temperature (°C)

	J	F	M	A	M	J	J	A	S	O	N	D	YR
XTRM MAX	1.7	0.6	5.0	8.9	20.0	28.3	27.8	30.1	18.3	15.0	7.8	1.7	28.9
AVERAGE	-24.9	-27.3	-23.5	-16.3	-4.2	5.0	10.6	8.2	1.7	-7.9	-18.9	-24.1	-10.1
XTRM MIN	-51.1	-52.2	-42.2	-38.9	-30.6	-8.9	-6.7	-5.6	-13.3	-30.0	-42.8	-47.2	-52.2

(b) Greatest 24-hour rainfall (mm)

MONTH	
Jan.	0.0
Feb.	0.0
Mar.	0.0
Apr.	Trace
May	7.6
Jun.	12.7
Jul.	27.9
Aug.	33.5
Sep.	22.9
Oct.	12.7
Nov.	0.0
Dec.	0.0

(c) Greatest 24-hour snowfall (cm)

MONTH	
Jan.	15.2
Feb.	5.1
Mar.	10.2
Apr.	14.0
May	12.7
Jun.	2.5
Jul.	0.0
Aug.	7.6
Sep.	12.7
Oct.	14.0
Nov.	17.8
Dec.	7.6

(d) Mean monthly rainfall (mm)

MONTH	
Jan.	0.0
Feb.	0.0
Mar.	0.0
Apr.	0.0
May	2.3
Jun.	18.0
Jul.	39.1
Aug.	35.8
Sep.	13.5
Oct.	1.5
Nov.	0.0
Dec.	0.0
Total	110.2

(e) Mean monthly snowfall (cm)

MONTH	
Jan.	9.4
Feb.	3.0
Mar.	6.9
Apr.	8.9
May	6.1
Jun.	1.3
Jul.	0.0
Aug.	3.6
Sep.	8.4
Oct.	22.6
Nov.	8.9
Dec.	4.1
Total	83.2

(f) Mean number of days with fog

Jan.	2
Feb.	2
Mar.	1
Apr.	3
May	8
Jun.	9
Jul.	5
Aug.	9
Sept.	8
Oct.	5
Nov.	2
Dec.	1
TOTAL	55

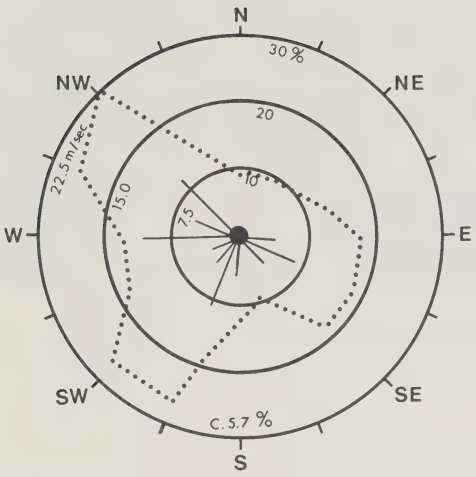
(AES, 1985)

Table 6

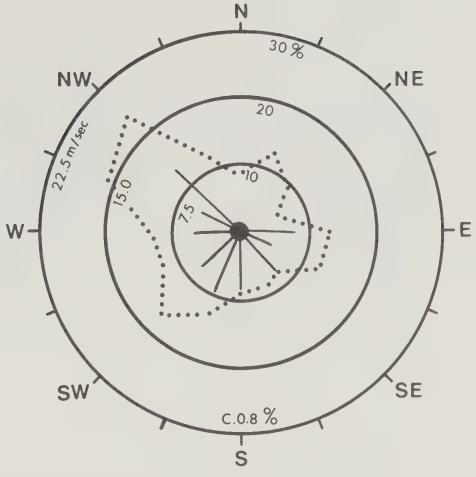
Summary of Wind Data for Shingle Point
(from Parker and Alexander, 1983)

MONTH	WIND SPEED			WIND DIRECTION
	% time 20 kph	% time 40 kph	% time calm	
January	40.5	14.9	2.6	SW 25.4%; NW 24.4%
February	35.4	13.1	1.4	NW 31.1%; SW 21.4%
March	20.4	3.0	1.7	NW 26.8%; S 20.9%
April	11.2	1.0	2.7	NW 31.0%; N 26.3%
May	12.3	0.8	0.8	NW 27.2%; N 23.0%
June	24.6	0.6	0.3	N 26.1%; NE 25.5%
July	30.3	2.8	0.1	NE 20.3%; NW 19.9%
August	28.3	2.4	0.2	NW 29.8%; N 13.6%
Sept.	33.0	3.3	0.5	NW 25.2%; SW 13.8%
Oct.	35.0	6.3	2.4	NW 27.4%; SW 14.4%
Nov.	50.0	22.4	0.9	SW 30.3%; NW 17.1%
Dec.	33.0	11.3	3.2	NW 30.6%; W 20.1%

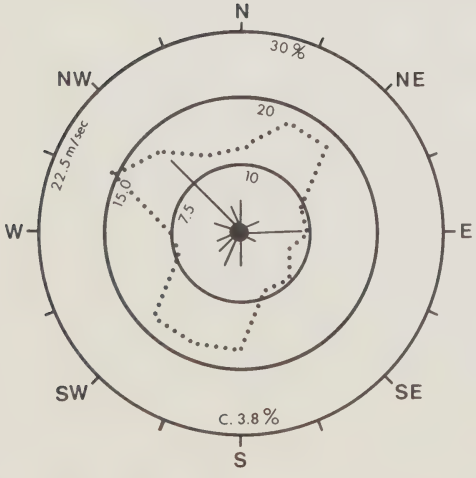
Wind Roses for Shingle Point
(from Parker and Alexander, 1983)



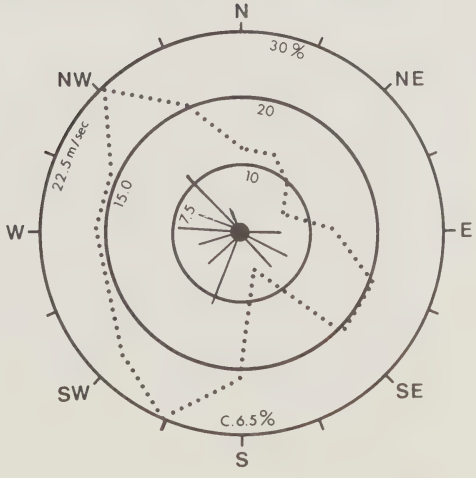
Jan. Feb. Mar.



July Aug. Sept.



Apr. May June



Oct. Nov. Dec.

Figure 23

1.3 Winds

Although the prevailing winds in the Shingle Point region are from the northwest (parallel to the British and Richardson Mountains), there is a strong and persistent southwest component throughout the year which is the result of the Blow River valley located southwest of the station (Parker and Alexander, 1983). Parker and Alexander (1983) speculated that King Point would experience strong southwest winds during the fall and winter similar to those at Shingle Point as a result of the Babbage River valley located to the southwest. Winds speeds for other directions throughout the year at King Point would be similar to those for Shingle Point (Table 6 and figure 23).

1.4 Daylight Regime

Figure 24 shows the daylight regime at the King Point latitude (69° 06'N). The sun is continuously below the horizon between late November and mid January and continuously above the horizon between late May and late July.

1.5 Atmospheric Inversions

Atmospheric inversions (an increase in air temperature with height) are caused by the negative radiation balance over the snow and ice surfaces which are present during the greater part of the year in the north (Burns, 1973). Low sun angle, high albedo and the short winter days combine to produce low-level atmospheric radiational cooling. When these conditions combine with high level warm air subsidence or warm air advection the inversions are maintained and intensified, with resultant implications for air quality and visibility.

During the summer months onshore winds will usually produce strong low level (surface based) inversions. Unless there is an unusually strong southward surge of arctic air the air masses over the King Point region are relatively warm compared to the cold water of the Beaufort Sea and this will normally produce a shallow layer of cold air with warm air aloft - inversion conditions. Near the coast, because of the continued influx of cold air, daytime heating cannot destroy the inversion conditions; a change in wind direction is usually required (Neil Parker, Environment Canada, personal communication). During these periods, winds are usually strong enough to produce reasonable ventilation but during the winter months - when an inversion is present nearly continuously - the greater frequency of light winds and calm will produce episodes with the potential for high levels of air pollution (Dome et al., 1982).

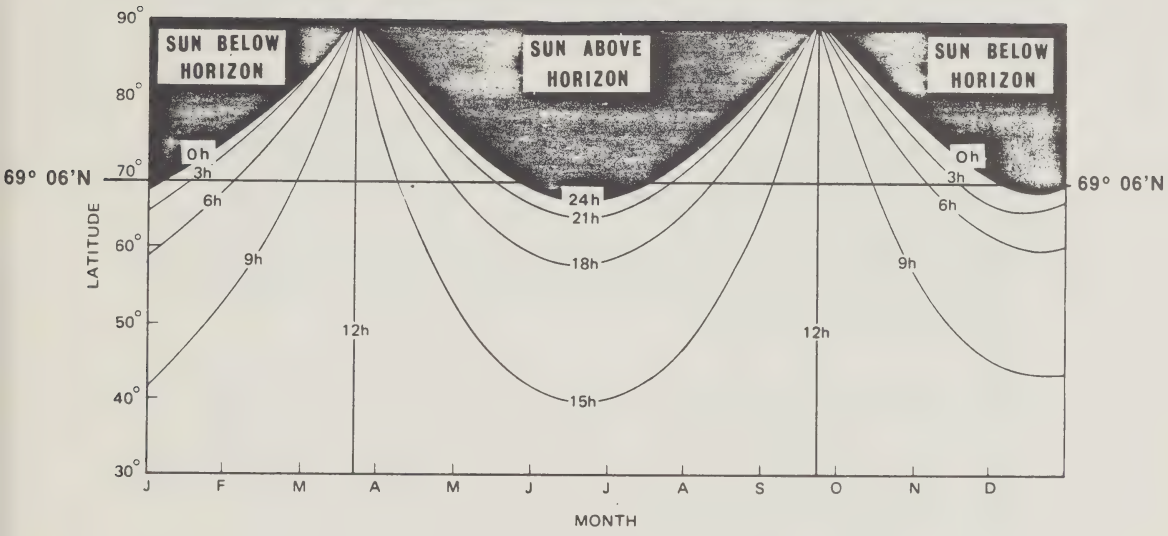


Figure 24 Daylight Regime at King Point, Yukon
(from Burns, 1973)

1.6 Visibility

Gulf (1982) reported that visibility in offshore areas in the Beaufort would be restricted to less than 5km horizontally and 300m vertically 37% of the time in summer months and would be "severely restricted" (1.6km/150m) 16% of the time. During mid winter, of course, the sun does not rise above the horizon, although it would rarely be totally dark at all times. Frequencies of restricted visibility according to Gulf (1982) are 16% and 7% respectively for the November through April period at Tuktoyaktuk. Similar winter values can be expected for the King Point area.

Major factors reducing visibility in the King Point area are advection fog, steam fog, ice crystal haze and blowing snow. Heavy precipitation can reduce visibility at any time. Although whiteout conditions do not restrict visibility per se, perception of depth, distance and orientation is lost and travel can be hazardous.

Advection fog is caused by warm moist air flowing over cold waters. The frequency of fog occurrence at Shingle Point is nearly uniform from May to October (8-9 days/month) and fog can cover extensive stretches of coastline for long periods.

Steam fog is a mainly winter phenomenon created when moisture from open water condenses in the cold air and is mainly associated with open leads and tidal cracks in the sea ice cover. As steam fog is relatively localized and persists for only a few kilometres downwind from the open water, it is not significant at King Point at present. However, if King Point is developed as a year-round harbour then the occurrence of steam fog could become more frequent.

Ice crystal haze, normally associated with the clear skies and low temperatures of Arctic high pressure systems, may extend over wide areas but usually does not lower the visibility below 3 km.

Blowing snow is the most common visual obstruction in winter. Powder snow will start to drift in winds of 14 to 30 kph. Winds in excess of 50 kph usually produce visibilities of less than 800 metres, and in cases of fresh snowfall, near zero (Burns, 1973). If there is no snow falling, visibilities will gradually improve as the snow drifts and compacts, even though winds do not decrease. A change in wind direction, even with lighter winds, can result in another episode of blowing snow as the snow is redistributed (Parker, personal communication).

Whiteouts occur when light is diffusely scattered during multiple reflections between a uniform low overcast sky and an unbroken snow cover beneath it, and are intensified by a low angle (Burns, 1973). White objects and surface irregularities become invisible and perception of distance is difficult. Whiteouts occur most often in late winter, early spring and autumn.

Ice fog usually results from the direct sublimation of moisture on hydrocarbon particles and occurs less frequently in uninhabited areas because the low moisture content of arctic air masses prevents ice crystal foundation. However, as human activity in the north increases, so does ice fog. At temperatures below -40°C, it is likely to persist due to the inversion conditions and light winds which normally accompany these cold temperatures. Increasing wind speeds or temperatures will rapidly dissipate ice fog, however.

Overall, the worst flying conditions along the Beaufort coast occur during the summer and fall (Burns, 1983).

1.7 Icing

Icing occurs in forms ranging from hoarfrost to glaze ice and under a variety of conditions. Mountainous coastal regions with open water and frequent onshore wind conditions, and high latitude areas with nearby open water in autumn and winter are prime areas for icing conditions (Burns, 1983). The risk of icing is lowest in winter, increases through spring and reaches a maximum in fall, when open water, cold temperatures and stormy weather coincide. Icing could easily be a problem at King Point, both for flying aircraft and for surface based structures.

2.0 The Physical Environment

2.1 Offshore

2.1.1 Currents

The northermost part of Mackenzie Bay is influenced by the clockwise moving currents of the Beaufort Gyre which flows westward at an average peripheral speed of about 1.4 km hr^{-1} (MacNeill and Garrett, 1975). Currents in central and southern Mackenzie Bay on the other hand are primarily wind-driven. The prevailing northwest winds should, in theory, cause southeasterly longshore currents along the Yukon coast and counter-clockwise circulation in Mackenzie Bay. However, MacNeill and Garrett (1975) reported speculation that a small clockwise gyre in Mackenzie Bay is set up during northwest winds, causing a northwesterly longshore current along the Yukon coast. A similar flow would result from easterly winds. However, the clockwise gyre theory has not been substantiated, and net sediment transport immediately near shore at King Point is definitely to the southeast (McDonald and Lewis, 1973). MacNeill and Garrett (1975) noted that "water movement in the southwest corner of the bay off Shingle Point appears to be quite random most of the time, probably due to Mackenzie River eddies and the geographical configuration of the bay."

2.1.2 The Wave Regime

Maximum potential wave fetches at King Point are over several hundred km from the north, northwest and northeast and about 70 km and 100 km to the east and southeast respectively, when ice is absent (which is rare, even

if one excludes the polar pack). Maximum significant wave height (one year return period) is about 2-3 m; the 25 year return period wave is about 4 to 5 m (Public Works Canada, 1971). During storms, however, the rate of coastal erosion is considerable because of the narrow beaches and ice-rich, unconsolidated sediment bluffs. O'Connor and Associates (1985) summarized the Babbage Bight wave regime.

- waves less than 1 m in height occur 78% of the time and account for about 30% of the annual wave energy;
- waves 1-2 m in height occur 20% of the time and account for 50% of the annual wave energy ("intermediate storm waves"); and
- waves greater than 2 m in height occur about 2% of the time and account for 20% of the annual wave energy.

2.1.3 The Water Column

The turbidity, temperature and salinity of water in Mackenzie Bay are strongly influenced by the freshwater discharge from the Mackenzie River and the associated silt load as well as insulation, ice cover, and winds. However, detailed studies have not been completed and the following discussion, derived largely from Herlinveaux and de Lange Boom (1975), is necessarily general.

In winter, water clarity in Mackenzie Bay is high primarily because decreased Mackenzie River discharge results in less silt input and because of decreased biological productivity. Decreased fresh water input results in an increase in salinity and as the winter progresses sea ice formation contributes to a further increase in the salinity. Herlinveaux and de Lange Boom (1975) reported the formation in winter of a nearly isothermal and isohaline water layer extending to 40 or 50 metres depth, beyond which the temperature decreased and salinity increased. Temperature for the upper layer ranged between -1.65°C and -1.85°C, and salinity ranges between 30.0 °/oo and 33.5 °/oo. Mixing generated by wind over open leads and by under ice currents was observed to extend to considerable depths as a result of the small salinity and temperature gradients in this layer.

In summer, large volumes of fresh water and the warming effects of solar radiation produce a relatively fresh and warm surface layer which overlies cold saline seawater. Mixing processes are confined to the shallow (10 m) surface layer. Increased biological productivity and silt load, particularly from the Mackenzie River, produce a dramatic increase in turbidity. Surface layer salinity and temperatures are directly influenced by wind, currents, ice cover and proximity to fresh water sources and therefore vary considerably from site to site and from time to time. For example, salinities can range from 0 °/oo to 31 °/oo and temperatures from 0°C to 13°C (Herlinveaux and de Lange Boom, 1975). The warm, fresh surface layer is particularly important for coastal fish migration.

Wong et al. (1980) gathered chemical baseline data in the southern Beaufort Sea. Two of the sample stations were in Mackenzie Bay about 12 km and 20 km north of King Point, respectively, and the data collected for these sites are shown in Table 3.

Sampling for hydrocarbons was also undertaken. Concentrations of polycyclic aromatic hydrocarbons (PAH) varied inversely with salinity, and concentrations in nearshore waters showed considerable variability, probably as a result of proximity to Mackenzie River outflow (the Mackenzie flows through regions with known fossil fuel deposits). Generally, concentrations were considered to be relatively low in the water column, in marine fish and in marine marine sediments. Non-polar hydrocarbon concentrations showed relatively high levels, indicating marginal contamination.

Overall, Wong et al. (1980) concluded that the very low levels of hydrocarbons in the Beaufort indicated "a marine environment of extreme cleanliness with respect to petroleum hydrocarbons."

2.1.4 The Ice Environment

The Beaufort Sea offshore King Point is exposed to two separate ice regimes: the landfast ice zone (almost entirely first year ice); and the polar pack (primarily multi-year ice). Mackenzie Bay is almost entirely within the landfast ice zone, although the infrequent intrusions of the polar pack have significant implications for shipping.

Mackenzie Bay is ice-covered about 9 months of the year. New ice begins to form in late September to early October and by mid October (October 11±13 days) freeze-up is complete. The landfast ice zone normally extends about 40 to 50 km offshore King Point but occasionally extends out as far as 90 km, depending on wind conditions and the proximity of the polar pack. Maximum ice thickness of about two metres is reached by late April, and melting usually begins in late May (Gulf Canada, 1982).

The landfast ice within 10 km or so of the coast is normally smooth and the remainder of the zone banded by ridges of varying severity, but significant ridging has occurred within 1/2 km of shore. Generally the most severe first year ridging occurs in a 5 to 10 km wide band grounded in 15 to 30 m water depths. Ridges here reach heights of 5 m and densities of 10 to 20 per km (Indian and Northern Affairs Canada, 1983c; Gulf Canada, 1982). Heavy ridging and hummocking will occur in first year ice nearshore if strong onshore winds force the ice pack into shallow waters during early freeze-up before the landfast "shelf" forms.

Break-up of landfast ice begins in late May and by early July (July 8 ±12 days) the area is usually ice free. The open water period lasts for about 91 days ± 20, but pack ice from the permanent pack to the north is occasionally pushed into Mackenzie Bay (Gulf Canada, 1982). In mid-September, 1970, for example, a severe storm packed the bay with multi-year ice floes, pressure ridges and several ice island fragments. Six of these fragments were observed within 3 km of the coast and the largest (75 m by 25 m and 20 m thick) was grounded in 10 m of water (Public Works Canada, 1971). Subsequent freeze-up held the pack in place. On July 2, 1976 a major storm resulted in 6/10 multi-year ice coverage off King Point.

TABLE 7

Chemical Baseline Data, Mackenzie Bay, Yukon

Station: 47 (69°13.5'N; 137°54'W)
Sampled: 0044 GMT; 21/08/75
Total depth: 27 m

Depth (m)	Temp (°C)	Salinity (°/oo)	Oxygen (ml/l)	Percent Sat. O2	Phosphate uq. at/l	Silicate uq.at/l	Nitrate uq.at/l
0	3.9	14.640	8.41	100.9	0.14	16	0.0
3	3.27	14.839	8.44	99.8	0.14	15	0.0
5	2.83	15.034	8.36	97.8	0.18	15	0.0
7	2.83	16.640	8.36	98.9	0.22	14	0.0
10	0.02	21.089	8.82	99.8	0.43	8	0.0
15	-0.36	29.437	8.87	105.1	0.99	10	1.7
20	-1.27	31.287	7.74	90.6	1.33	18	7.0
25	-1.39	31.510	7.67	89.7	1.39	18	7.0

Station: 38 (69°18'N; 137°53'32"W)
Sampled: 0210 GMT; 23/08/74
Total depth: 35 m

0	-	4.15	-	-	0.03	-	2.0
1	1.87	4.51	9.1	96.7	0.01	-	1.0
3	-	5.78	9.4	-	0.00	-	0.0
5	0.57	6.05	9.1	94.3	0.03	-	0.0
7	0.63	6.74	9.1	94.9	0.00	-	0.0
10	-1.06	24.00	8.6	96.3	0.81	18	4.0
15	-1.46	28.85	8.5	97.4	1.01	16	4.0
20	-1.60	30.44	8.5	98.1	1.15	14	5.0
25	-1.64	31.20	8.4	97.3	1.18	14	5.0
30	-1.64	31.31	8.2	95.1	1.30	14	5.0

(from Wong et al., 1980)

Overall, the amount of multi-year ice from the polar pack which enters Mackenzie Bay varies from year to year, depending on storm frequencies and the prevailing winds. Multi-year ice occurs in about one winter of every four or five and in concentrations up to 30% of the total ice coverage (Indian and Northern Affairs Canada, 1983).

2.1.5 Bathymetry

The bathymetric gradient off King Point (figure 2) is steeper than at any other site along the Beaufort coast between Herschel Island and Cape Parry. The short distance to deep water (2.2 km to the 20 m contour) is the most attractive feature of the area in terms of harbour potential.

2.1.6 Marine Sediments

O'Connor and Associates (1985) report that the surficial marine geology offshore King Point consists of two stratigraphic units - a recent marine sequence of soft, plastic clays with some silt, and an older, much stiffer clay and silt sequence. The latter was deposited on the Yukon coast, subsequently eroded during the most recent marine transgression and is exposed nearshore. Further offshore, the soft clay sequence overlies the older clay-silt sequence.

Ice-bonded frozen soils (temperatures about -2° to -3°C) are present offshore, but massive ground ice has not been detected (O'Connor and Associates, 1985).

2.2 The Coastal Zone

2.2.1 Morphology

The coastline in the King Point area is characterized by high (up to 50 m) unconsolidated, ice-rich, sediment cliffs that are locally protected by narrow beaches. The cliffs - interbedded sequences of marine and fresh-water fine grained sediments, peat layers and wedges of sandy and gravelly sediment - are subject to retrogressive thaw flow slides initiated and aided by storm surges which undercut the cliffs and originate and contribute to ground ice melting. Annual coastal retreat is the range of 0.5 m to 2.0 m.

Beaches are typically composed of sands and gravels, and fine-grained sediments occur locally due to mud flows from sites of thermokarst erosion (Woodward-Clyde, 1981). Figure 18 shows the coastal morphology of the King Point area.

The shallow lagoon, less than 3 m in depth, if dredged and the barrier bar built up to prevent wash-over, would offer the only protected anchorage in the area. There is no safe anchorage off King Point as the deep offshore waters allow close inshore penetration of wind-blown ice from the north, northwest and northeast.

2.2.2 Coastal Processes

Coastal processes are dominated by strong winds and associated wave action and longshore current drift associated with low pressure systems moving through the region. The large available fetch to the north, northeast and northwest ensures strong onshore wave action, undermining exposed coastal bluffs and causing slumping. This process provides nearly all the sediment in the coastal zone in the vicinity of King Point as there are no nearby rivers to contribute sediment.

The rate of current flow along the coast varies in response to wind-driven heads of water and is therefore strongest during and immediately following storm surges. Coastal erosion and longshore sediment transport peak at the same time (McDonald and Lewis, 1973).

The rate of coastal change is both location and time-dependent. In 1826, Franklin mapped "a wide, though not deep bay, whose points were named after my friends Captains Sabine and P.P. King" (Franklin, 1823). Subsequent coastal erosion, the formation of barrier or bay-mouth bars at King Point and Harbour Lagoon and the development of wide (up to 25 m) beaches in some areas have essentially straightened the coastline between King Point and Shingle Point. MacDonald and Lewis (1973) documented the recession of King Point using historical records and determined that in some areas coastal retreat of up to 200 m took place between 1906 and 1970. In the period 1952-70, coastal retreat of as much as 20 m between King and Kay points is indicated by aerial photography but long stretches of the coast were apparently stable throughout this period (McDonald and Lewis, 1973). For example, the stretch of coast for 5 km west of King Point showed no measurable change between 1952 and 1970, perhaps in part because of a protective 15-20 m wide strip of beach. On the other hand, the spit at King Point grew southeastward by 425 m between 1952 and 1972 and now forms a barrier bar which encloses the lagoon. The bar is 30-40 m wide at its narrowest (the northwest end), about 150 metres wide at its widest (the southeast end), and is one to two metres high. It washes over during most storms.

The direction of sediment transport along the coast is determined largely by wave approach directions. The net sediment transport pattern for the King Point area is illustrated in figure 18. Silt and clay are transported into the sediment sink at Phillips Bay by northwestward flowing currents, into the sediment sink at Shoalwater Bay by southeastward flowing currents and by surf action to offshore locations. Gravel and sand is deposited in nearby beaches, spits, bay-mouth bars, lagoons and offshore bars. The extension of the King Point spit into a barrier bar, rapid coastal erosion, parallel bathymetric contours and the steep gradient all point to strong nearshore current flow.

Keith Philpott Consulting Ltd. (1985) computed a gross longshore sediment transport rate of 27 000-32 000 m^3yr^{-1} at King Point and a net annual transport rate of 9 000 m^3 to the east and 3 000 m^3 to the west. O'Connor and Associates (1985) report an estimated gross sediment transport rate of 20 000 to 40 000 m^3yr^{-1} based on historical accumulation rates for the King Point barrier bar; this figure agrees well with the Philpott estimates.

The ground ice content in the coastal cliffs in the King Point area and indeed the entire Beaufort Sea coastline is extremely high. Dobrocky (1985) stated that it may be more accurate to say that the coastline is melting away rather than eroding away and that the rate of coastal retreat is disproportionately high compared to the actual amount of sediment generated.

2.3 Onshore

The Yukon Coastal Plain physiographic subregion of the Arctic Coastal Plain is largely an erosion surface (pediment) cut in bedrock and mantled with a veneer of recent sediments. Rampton (1982) subdivided the Yukon coastal plain into two physiographic parts:

- a coastal fringe about 11 km wide with unconsolidated deposits generally over 60 m thick, negligible regional slope and minor topographic undulations; and

- a mountain fringe with a gentle coastward slope and covered by unconsolidated deposits between 1 1/2 and 30 m thick.

King Point lies entirely within the coastal fringe and the quarry site identified by Kiewit lies on the boundary of the mountain fringe. For the purposes of this discussion, the entire project area can be considered to be within the coastal fringe.

2.3.1 Glacial History

The King Point area was glaciated by ice moving west from the lower Mackenzie River during the early part of the Wisconsin glaciation (the "Buckland Glaciation", Rampton (1982)). The entire coastal plain east of the Firth River and the northern fringe of the British, Barn and Richardson mountain ranges was ice-covered during this period.

The ridge of glacially deformed sediments (primarily marine clays and silts) of pre-Buckland age which parallels the coast between Kay and King points (figure 17) was formed during the Sabine phase through ice thrusting or through squeezing out of unconsolidated sediment from under the edge of the glacier (O'Connor and Associates, 1985). Glacially deformed marine, floodplain and deltaic sediments are exposed in cliffs west of King Point and marine and freshwater sequences are exposed between Shingle and King points (Rampton, 1982). Glacial till (generally less than 5 m thick) forms much of the topographic highs in the King Point region. Kame terraces, kame deltas, abandoned meltwater channels and other features of glacial origin are present in the region.

Eastward retreat of the ice was interrupted by a stand-still that produced coalescing outwash fans of sand, gravel and silt on the landward side of the ridge running from Kay Point to beyond Shingle Point. Massive ground ice is locally present within this outwash fan apron and within the underlying sediments. Rampton (1982) termed this stand-still the "Sabine Phase" of the Buckland Glaciation.

Following deglaciation, thermokarst erosion created basins, some of which now contain lakes and some of which contained lakes which have subsequently drained, e.g., near Sabine Point and the lagoon at King Point (O'Connor and Associates, 1985). The gently rolling topography of the King Point region is the direct result of this thermokarst activity. Ground ice formation, particularly ice wedges and ice lenses, followed deglaciation and continues today as does thermokarst erosion although the latter is, according to Rampton (1982), now much less active.

2.3.2 Topography

The King Point area of the coastal plain is hummocky and lake-covered due to the presence of glacial deposits left by the Buckland glaciation and subsequently modified by thermokarst processes. It can be characterized as a rolling till plain with numerous lakes and ponds.

Standing water bodies are variable in size, ranging from small ponds to lakes tens of hectares in area and have been formed through thermokarst processes or relict ice melt. Small wetland streams and two larger rivers, the Babbage River and Deep Creek, drain the area around King Point.

Coastal bluffs composed of ice rich unconsolidated sediments are up to 50 m in height and drop sharply to the narrow gravel beach. Coastal recession is rapid and dramatic in some places, and the rate of retreat ranges up to 5 m per year.

Special features in the vicinity of King Point include massive coastal slumping (retrogressive thaw flow slides), pingos, thermokarst subsidence and active layer detachment slides.

2.3.3 Permafrost

Although the Yukon coastal plain lies in the continuous permafrost zone, the thickness of the active layer varies according to vegetation cover and surficial deposit type. Rampton (1982) reported that the active layer ranges from less than 30 cm in thickness for peat and moss-covered lacustrine sediments to a metre and more in thickness for gravels and sands with broken vegetation cover.

Permafrost thickness ranges from over 300 m over most of the coastal plain to shallower depths under recently drained lake basins and the outermost edges of deltas, and river channels (Rampton, 1982). Taliks occur under large lakes and the Babbage River. Average ground temperature is -8.5° $\pm$ 1.5°C in the King Point area (Rampton, 1982).

2.3.4 Soils

Soils in the King Point area are cryic gleysols - ice-rich, acid and poorly drained.

Frost-wedged organic material covers fine-grained lacustrine and fluvial materials in low-lying poorly drained areas. For example, gravel deposits in the form of outwash fans common on the landward side of the

Kay Point-Shingle Point ridge are commonly covered by 3 to 5 m thick organic caps because of the gentle slopes and perched water tables. Organic material also covers the poorly drained areas of the fine-grained fluvial terraces along Deep Creek. On topographic highs - usually glacial till - where good drainage has been maintained, organic cover is thin or absent.

2.3.5 Surficial Deposits

Rampton (1982) completed a surficial geology map of the Yukon coastal plain and determined that surficial deposits in the King Point area fall into a number of broad categories, primarily: fluvial; glaciofluvial; lacustrine; marine; morainic; organic; and glacially deformed. Figure 17 illustrates the distribution of these deposits.

Lacustrine deposits (fine grained, ice rich sediments) form a lacustrine plain to the southeast of King Point; glacially deformed sediments (fine grained, ice rich marine, fluvial and lacustrine sediments) form a coastal ridge between Kay and King Points; morainic (coarse grained and ice-rich till deposits) are widespread and include the ridge marking the Sabine Phase standstill to the south and east of King Point); glaciofluvial (outwash fans of coarse grained low ice-content materials) are found to the northwest and southeast of King Point. The latter is on the inland side of the Sabine Phase moraine; and fluvial (fine grained, ice rich sediments) terrace deposits are found in the Deep Creek and Babbage River valleys.

Typical stratigraphic sequences have been identified by O'Connor and Associates (1985):

- under lacustrine plains	0-4 m of peat 2-8 m of lacustrine silts 1-10 m of glacial till 20 + m of usually fine grained perimarine sediments;
- under rolling morainal deposits	0.3-0.8 m of a peat, pond silts, alluvium or collovium complex 2-10 m of glacial till 5-10+ m of massive ice 20 + m of perimarine sediments;
- under glaciofluvial deposits	0-8 m of organic silt and peat 5-20 m of gravel and sand 5-10+ m of massive ice 0.5 m of glacial till 10 + m of perimarine sediments

2.3.6 Ground Ice

Generally, glaciofluvial deposits contain large thicknesses of massive ice and low to moderate ice contents (15-20 °/o visual ice) within the sediments themselves. Morainal deposits contain much excess ice (greater than 30 °/o visual ice), usually as ice lenses and beds. Alluvial

deposits contain high ice contents in the upper 2 m to 3 m and little or no ice in the underlying deposits. Moderate to very high ice contents are also found in lacustrine deposits but little or no ice is found in the underlying deposits, eliminating the likelihood of further thermokarst subsidence in these areas. The ice content of colluvial material is generally high but the ice content of the underlying deposits will vary according to depositional history and grain size characteristics. Organic deposits have high to very high ice contents, including active ice wedges, and perimarine deposits and bedrock have very low ground ice contents.

2.3.7 Bedrock

Rampton (1982) reported that east of the Firth River, Upper Cretaceous shale, mudstone, sandstone and conglomerate, and Tertiary sandstone, conglomerate coal and shale are widespread and overlie Jurassic and Lower Cretaceous shale and quartzose sandstone. Much of the coastal plain consists of an erosion surface - pediment - overlain by unconsolidated sediments; bedrock outcrops are rare.

2.3.8 Terrain Sensitivity

The nature and degree of the response of northern terrain to mechanical disturbance depends primarily on the ice content of the surficial materials, surficial sediment type and particulate size slope angle, the nature of the insulating cover and, of course, the nature of the disturbance (Van Eyk and Zoltai, 1975).

As noted above, the main surficial sediment types in the King Point region are: lacustrine; glacially deformed, unconsolidated sediments; morainic; glaciofluvial; and fluvial. Van Eyk and Zoltai (1975) developed sensitivity and disturbance level scales for each deposit type they mapped in north Yukon and the Mackenzie River valley; the sensitivity scale ranged from 1 to 7, where 7 is the most sensitive, and the disturbance scale was based on the nature of the disturbance, as follows:

a - disruption of the organic mat;
b - removal of the organic mat or the top 20 cm of organic terrain;
c - disruption of mineral soil;
d - removal of mineral soil; and
e - excavation of mineral soil to ice rich or finer textured materials.

A terrain sensitivity level of 7 and a disturbance level of (e) would therefore indicate the potential for major disruption.

Van Eyk and Zoltai (1975) assigned fluvial deposits (the Deep Creek valley) in the King Point area terrain sensitivities of 3 (coarse sediments) and 5-6 (fine material) and disturbance levels of (d) and (c), respectively. Disturbance could cause gully erosion and thermokarst, and thermokarst in coarse sediments and retrogressive thaw flow slide slumping, respectively in areas of finer sediments.

Glaciolacustrine and thermokarst lake deposits (immediately to the southeast of King Point) were assigned a terrain sensitivity of 7 and a disturbance level of (a). Failure types could include retrogressive thaw flow slide slumping and thermokarst.

Rolling to hummocky moraine predominates in the King Point area; a terrain sensitivity of 5 and a disturbance level of (b) was assigned. Failure types could include active layer detachment slide and retrogressive thaw flow slide slumping and gully erosion.

Glacially deformed sediments along the Kay Point to King Point ridge were assigned a terrain sensitivity of 6 and a disturbance level of (c). Failure types include thermokarst subsidence, gullying and slumping. These estimates of terrain sensitivity are similar to those developed by O'Connor and Associates (1985) and provide a guide to those areas which should be avoided by builders and those areas which could provide a relatively stable foundation if appropriate care is taken.

3.0 The Biological Environment

3.1 The Marine Environment

3.1.1 Fish

Relatively little is known about fish utilization of nearshore and offshore waters in the King Point area. The only extensive studies available for this area were done by Slaney (1975) and Kendel et al. (1975), the latter as part of the Beaufort Sea Project. The Slaney study was primarily a freshwater survey but also included King Point lagoon.

Because the data base is limited, only general statements can be made about fish use of the coastal area. Waters offshore King Point do not appear to provide important feeding or spawning habitat (Kendel et al., 1975) but the narrow zone of warm, brackish - almost fresh - water within a few hundred metres of shore does serve as a very important migration corridor for whitefish and cisco.

Table 8 provides a summary of the fish species which have been reported for offshore King Point. The most important fish species in the Beaufort are coregonids - broad, humpback and lake whitefish, arctic and least cisco and inconnu - of which only the cisco species and broad and humpback whitefish have been recorded at King Point.

Coregonids appear to be restricted to the brackish coastal waters, apparently not venturing into cold, saline offshore waters and are therefore not "anadromous" in the usual sense (LGL, 1982). The five-metre depth contour appears to be the maximum depth for coastal migration (Bill Bond, Fisheries and Oceans Canada, personal communication).

Beaufort coregonids spawn in coastal freshwater bodies, particularly the Mackenzie system, in the fall. Adult fish and fry overwinter in freshwater, move to the coast with spring breakup and then east and west

along the coast within the warm brackish zone. In August or September, the coregonids move to freshwater spawning and overwintering areas. Migratory movements vary according to species; lake whitefish and inconnu, for example, do not move far from the Mackenzie delta and have not been recorded at King Point; arctic and least cisco on the other hand move farther east and west - arctic cisco perhaps as far west as the Colville River delta in Alaska (Gallaway et al., 1983) - but still remain within the warmer, less saline nearshore zone.

King Point lagoon is brackish because of storm surge and tidal washover. Slaney (1975) reported the presence of Arctic cisco and broad and humpback whitefish within the lagoon in summer and the presence of burbot has also been recorded in the lagoon.

In summary, the waters off King Point are not known to be important feeding or spawning habitat, but large numbers of fish do migrate through the area. Epibenthic invertebrates are the major prey although planktonic copepods are also important in the diet of some marine fish (Kendel et al., 1975).

3.1.2 Benthos and Epibenthos

Kendel et al., 1975 reported the results of sampling at three sites in the immediate area of King Point. The results of the 1975 program are shown in Table 9. In general the samples reflect an estuarine situation with King Point (station 100) showing the greatest density of benthic and epibenthic organisms of all sites sampled along the Yukon coast. This is perhaps surprising given that Fisheries and Oceans Canada (1983) has determined that King Point offshore is not important fish habitat. Large concentrations of bowhead whales have been observed in this area however (see below).

3.1.3 Marine Mammals

The marine mammals that occur most commonly in the King Point area are beluga and bowhead whales, ringed and bearded seals and polar bear.

3.1.3.1 Beluga Whale

The beluga (Delphinapterus leucas) is a small (4 m) toothed, highly social white whale which occurs in large herds in Arctic waters. The total number of belugas in the Beaufort region is estimated to be between 7 100 and 17 700 animals (Norton and Harwood, 1985). The beluga population of the Beaufort Sea is resident only in summer; the population winters in the Bering Sea. Migration into the Beaufort begins in March and April through open water and leads in the polar pack ice and the polar pack-landfast ice transition zone (figure 25).

While in the Beaufort, belugas feed on a wide variety of fish and invertebrates of benthic and pelagic origin, but arctic cod and squid appear to be the major prey-items.

In the Mackenzie delta area, belugas concentrate for as yet unknown reasons in the warm, turbid, fresh and shallow waters of Kugmallit Bay,

Shallow Bay and the Garry-Pelly-Kendall Island area. Possible activities range from calving (unlikely; Norton and Harwood, 1985) and early rearing of calves to the shedding of outer layers of skin, but apparently the belugas do not feed in these waters (Dome et al., 1982). Natives from Aklavik, Inuvik and Tuktoyaktuk hunt the whales while they are in the Mackenzie delta area.

By early August, the number of belugas in the delta area declines sharply and the results of comprehensive surveys (Norton and Harwood, 1985) show that the animals are widely distributed throughout the southeastern Beaufort Sea, including the Yukon coast, at this time. Beluga migration out of the Beaufort is underway by late August and early September and follows the edge of the polar pack into the Chukchi Sea and Bering Strait.

The King Point area is not known to be of any special significance to belugas. Belugas have been observed near King Point throughout the summer months, but the relative importance of this area is probably minor and variable from year to year (Rick Hurst, Northern Environment Directorate, DIAND, personal communication).

3.1.3.2 Bowhead Whales

Bowhead whales are large (18 m) baleen whales which generally occur in small groups throughout the southern Beaufort Sea in summer. Like belugas, they winter in the Bering Sea and follow much the same migration routes. There are perhaps 4 000 animals in the entire western arctic population and most if not all enter the Canadian Beaufort during the summer months.

In the southern Beaufort Sea bowheads tend to summer mainly in the area landward of the 50 m depth contour. They do not concentrate in the Mackenzie Delta area, however, but generally remain widespread throughout the southern Beaufort. Prey items are primarily zooplankton, epibenthos, polychaete worms and bivalves.

The westward fall migration along the coast begins in late August and continues through October, just ahead of freeze-up.

Recent evidence points to consistent and heavy use of the nearshore waters of King Point by bowheads in August. In late August 1983, up to 800 bowheads were observed concentrated in a 10 x 37 km area along the Yukon coast centred on King Point. Smaller but still high concentrations were observed in the same area in August, 1984 (LGL, 1985) and again in 1985 (Hurst, personal communication). These aggregations are likely related to concentrations of prey ("hot spots"), the location of which may vary from year to year. The King Point area is no doubt important to bowheads from time to time, but the relative importance and the frequency of use are as yet unknown and will be determined only through additional field observations.

TABLE 8

Fish Species Reported For Mackenzie Bay Near King Point, Yukon

Species	Percent Composition - 1974 (n = 202)	Percent Composition - 1975 (n = 120)
Least Cisco	83.7	76.7
Arctic Cisco	7.9	16.7
Boreal Smelt	4.0	
Fourhorn Sculpin*	3.0	4.2
Arctic Cod*	0.5	
Humpback Whitefish	0.5	
Broad Whitefish	0.5	
Arctic Lamprey*		2.5
	100.0	100.0

* marine species

(from Kendel et al., 1975)

TABLE 9

Benthos and Epibenthos Reported For Mackenzie Bay
Near King Point, Yukon

(1) Ekman Dredge
(May, July and August 1975)

Order	Station E*	Station 100**
Polychaeta (species)	2	5
(individuals)	4	34
Amphipoda	2	2
	4	2
Isopoda	1	1
	1	2
Gastropoda	2	
	3	
Pelecypoda	2	1
	7	1

(2) Five-minute Epibenthic Trawl
(May, July and August 1975)

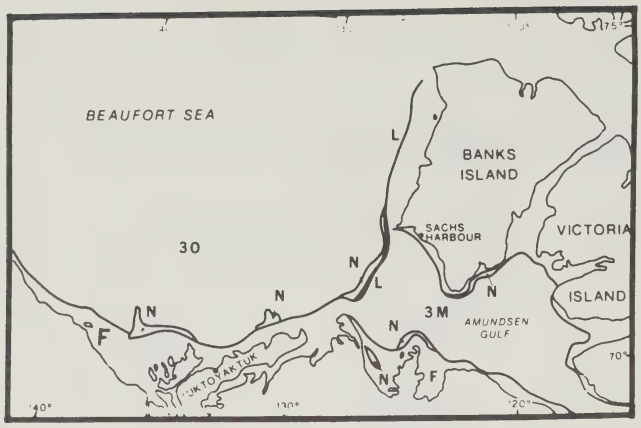
Order	Station 114***	Station 100**
Amphipoda		15
(# of organisms)		
Mysidacea	20	2100
Nemertea		2

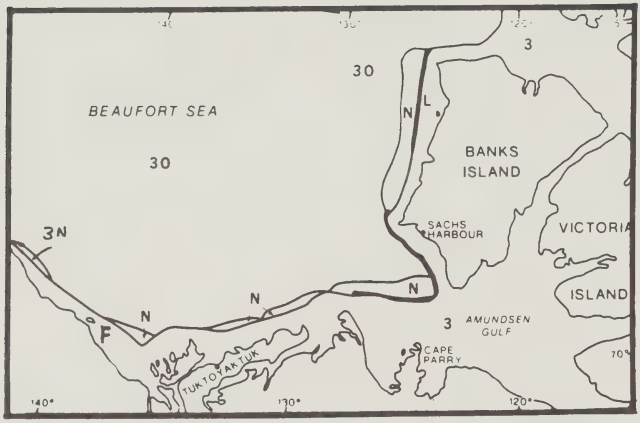
* station E: 2 km offshore (16 m water depth); -2°C; 30.1 °/oo; 0.07m^2 sampled; 9 species in all; 271 individuals m^{-2}

** station 100: nearshore (13 m water depth); 1°C; 28.3 °/oo; 0.23 m^2 sampled; 9 species in all; 168 individuals m^{-2}

*** station 114: inshore (2.6 m water depth); 9.7°C; 36.6 °/oo

(from Kendel et al., 1975)





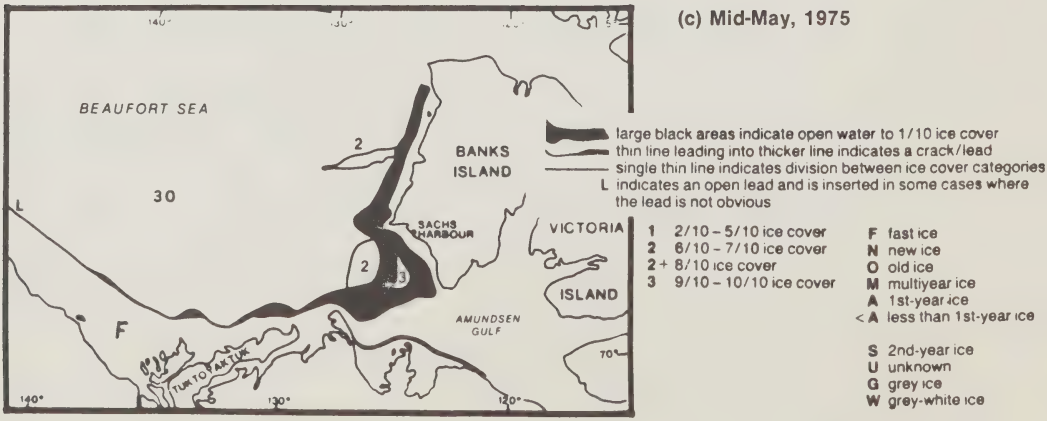


Figure 25 Offshore Lead System, Beaufort Sea (from Stirling and Cleator, 1981)

3.1.3.3 Ringed Seal

The ringed seal (Phoca hispida) is the most common marine mammal in the Beaufort, indeed in the entire North American Arctic, and is widespread in its distribution. It is the smallest seal, attaining an average adult weight of about 50 kg. The animal is resident year-round and maintains breathing holes in the landfast ice in winter. Although generally sedentary, undertaking only local movements in response to changing ice conditions, there is some evidence that in the western Arctic regular, annual movements occur both along the northern coast of Alaska and in the Canadian Beaufort. Population numbers in the Beaufort vary dramatically, ranging from about 23 000 in 1977 to 62 000 in 1978 (Dome et al., 1982).

During the period from late spring to early autumn, ringed seals in the central Beaufort Sea prey primarily on pelagic invertebrates, e.g., the amphipod Parathemisto libellula, while from November to April the main prey species is the arctic cod (Boreogadus saida).

The relative importance of the King Point area to ringed seals is unknown, although the density of hauled-out seals along the Yukon coast is among the highest in the Beaufort (Dome et al., 1982). The entire Yukon coast is considered secondary pupping habitat (Dome et al., 1982) and the very widespread distribution of ringed seals tends to lessen the importance of any one site, particularly if the area is relatively small.

3.1.3.4 Bearded Seal

The bearded seal (Erignathus barbatus) is a large solitary seal, attaining an average weight of 340 kg and a length of 2 m and ranges throughout Arctic waters. They are year-round residents but do not normally maintain breathing holes, although this has been observed during prolonged icebound periods. Instead, in winter the animal prefers to remain in shallow water areas in the transition zone or in nearshore pack ice areas. In summer bearded seals occur in open water overlying the continental shelf or in association with nearshore ice remnants, although the preferred habitat is loose pack over shallow waters (typically less than 50 m). Primary prey are benthic and epibenthic organisms. Population estimates vary, but perhaps 1 000 to 3 000 bearded seals are resident in the Canadian Beaufort (Dome et al., 1982).

Because the King Point area is solidly frozen over in winter, especially nearshore where the water is shallowest, bearded seals are unlikely to find suitable habitat. Observers have noted that bearded seals are relatively common near Herschel Island in summer (Dome et al., 1982) but whether this extends to the King Point area is unknown.

3.1.3.5 Polar Bear

The polar bear (Ursus maritimus) has a circumpolar distribution although it is primarily found in areas with sea ice most of the year. Its main prey species is the ringed seal although bearded seals are also important. During winter and spring, most adult males, non-breeding females, females with yearlings and two year olds and subadults in the

Beaufort show a strong preference for the floe edge and areas of moving ice with 6/10 or more ice cover, probably due to the accessibility of seals in these areas. Adult females with cubs of the year prefer stable landfast ice with deep snow drifts along the pressure ridges or snowbanks on leeward coastal hills. During late spring and summer, most bears remain on the retreating pack ice and continue to prey on seals.

Polar bear dens have been recorded on Herschel Island but the Yukon coastal plain, including King Point, is not known to be preferred polar bear habitat. However, bears are commonly seen on ice floes in the area during spring break-up and have been seen occasionally on the coast.

3.1.4 Marine Birds

The King Point area is not considered important habitat for marine birds. The most common marine bird species in the Beaufort are glaucous gulls, black-legged kittiwake, arctic tern, Sabine's gull and black guillemot and of these only the arctic tern is likely to nest in any numbers near King Point (ESL and LGL, 1982). Arctic terns nest on spits, barrier islands and tundra lakes throughout the north Yukon. Glaucous gulls, the most abundant gull species, are summer visitants and migrate along the coast in spring and fall, immature black-legged kittiwakes are widely distributed in low numbers, Sabine's gulls are coastal migrants and black guillemot are summer visitants (ESL and LGL, 1982).

3.2 The Terrestrial Environment

3.2.1 Flora

Vegetation in the King Point area falls under the broad category of arctic tundra, a vegetation zone dominated by moss, sedge, trailing heath and tussock communities (Table 10). The degree of drainage is the main determinant of vegetation distribution patterns: drier, well drained areas are dominated by trailing heath and tussock communities while sedges and mosses predominate in the wetter low-lying areas.

Vegetation on high, well-drained areas (usually glacial moraine) is predominantly tussock and trailing heath tundra composed of sheathed cottongrass and trailing shrubs including narrow-leafed Labrador tea, bog cranberry, dwarf birch, alpine blueberry, black crowberry, Arctic heather and marsh Andromeda. Mosses are locally abundant and several lichen species are ubiquitous but rarely abundant. The rounded tussocks formed by sheathed cottongrass are 25 to 45 cm high.

Vegetation in the low-lying areas is characterized by location. Low-centre polygons are covered by sedges and mosses (Sphagnum spp.) in the wet centres and by mosses, bog cranberry, marsh Andromeda, narrow-leafed Labrador tea and dwarf birch on the drier elevated rims. The dry central portions of the less common high centre polygons support the latter two species as well as bog cranberry, sheathed cottongrass, cloudberry and mosses while water sedge, cottongrass, shrub birch, cloudberry and mosses are found in the wetter ice-wedge troughs.

The numerous lakes and ponds of the King Point area are slowly being infilled by organic matter (peat) and exhibit vegetation zones related to water depth. Water sedge and other sedges, pendent grass, marsh cinquefoil and common mare's tail are found in the deeper water and the shallows; the wet perimeter supports aquatic sedge, creeping sedge and loose-flowered sedge, common and arctic cottongrass and grass species. Peat mosses (Sphagnum ssp.) are abundant. As peat accumulation proceeds and the water bodies become progressively smaller and peat filled, the drier sites are invaded by woody species including low willow species (diamond-leaf, veiny-leafed and netted willow), bog cranberry and dwarf birch. Willow and sedge growth forms a narrow band between the aquatic and foreshore vegetation and the surrounding tundra.

Small streams and channels support various willows, shrub birch and a variety of herbs including Lapland butterburr, northern marsh violet, delphinium-leaved monkshood and buttercups. In areas of restricted drainage and standing water, water sedge, common cottongrass, other sedges and willows are common. On the gravel floodplains in the larger creeks and river valleys thickets of Alaska willow reach heights of 4 m, a reflection of the warmer microclimate. Shorter willow species, Arctic lupin, Arctic fireweed and other herbs are also abundant on the floodplains. Mountain alder, alpine blueberry, shrub birch, alpine blueberry and Arctic lupin are common on the slopes above the streams.

There are no known rare plant species or unique plant communities in the King Point area and, with the possible exception of berry picking, the flora of the region is of no direct significance for human use as food. On the other hand the vegetation does provide important habitat for wildlife, particularly caribou, snow geese, grizzlies, waterfowl, passerines, small mammals and insects.

3.2.2 Mammals

3.2.2.1 Barren-ground Caribou

The King Point area of the Yukon North Slope is used by the Porcupine caribou herd primarily during spring migration when the herd is moving from wintering areas in the central Yukon to the northwest Yukon and Alaskan North Slope and during mid to late summer.

The herd uses two major migration routes to reach the calving grounds in spring - the Richardson Mountain route along the eastern Yukon boundary and adjacent areas of NWT and then west along the coastal plain (figure 17); and the Old Crow route, whereby caribou cross the Porcupine River near Old Crow and move into the north Yukon via the Firth or Babbage rivers.

The numbers of caribou using the Yukon coastal plain during the April-May period depends on the number using the Richardson route. Estimates in recent years range from 4 200 to 60 000 animals (YTG, 1983). (The herd is about 180 000 strong.) In any event, the calving component will move along the foothills at the southern edge of the coastal plain en route to

TABLE 10

Vegetation in the Area of King Point, Yukon

Family	Scientific Name	Common Name
birch	Alnus crispa	mountain alder
	Betula glandulosa	shrub, dwarf or glandular birch
	Betula nana	dwarf birch
composite	Petasites frigidus	Lapland butterbur
crowberry	Empetron nigrum	black crowberry
crowfoot	Aconitum delphinifolium	delphinium-leaved monkshood
	Ranunculus spp	buttercup
evening primrose	Epilobrium latifolium	Arctic fireweed
grass	Arctophila fulva	pendent grass
heath	Andromeda polifolia	marsh Andromeda, common bog-rosemary
	Arctostaphylos alpina	alpine bearberry
	Cassiope tetragona	Arctic heather
	Ledum palustre spp decumbens	narrow-leafed Labrador tea
	Vaccinium uliginosum	alpine blueberry
	Vaccinium vitis-idaea	bog cranberry
pea	Lupinus arcticus	Arctic lupin
primrose	Douglasia ochotensis	primrose
rose	Potentilla palustris	marsh or purple cinquefoil
	Rubus chamaemorus	cloudberry
sedge	Carex aquatilus	water or aquatic sedge
	Carex chordorrhiza	creeping sedge
	Carex rariflora	loose-flowered sedge
	Eriophorum angustifolium	common cottongrass
	Eriophorum vaginatum	sheathed cottongrass
violet	Viola epipula	northern marsh violet
water milfoil	Hippuris vulgaris	common mare's tail
willow	Salix alaxensis	Alaska or feltleaf willow
	Salix glauca	northern willow
	Salix phlebophylla	veiny-leafed willow
	Salix pulchra	beautiful or diamond-leaf willow
	Salix reticulata	netted willow

the calving grounds as forage is available in the foothills earlier than along the coast, while the non-calving component (bulls, yearlings and non-pregnant females), lagging behind, will be able to take advantage of its later arrival and forage nearer the coast. Perhaps 25-50% of the non-calving component of the Porcupine herd uses the King Point area each year from late May through mid June (Martell, 1983).

Peak calving activity occurs in early June and is concentrated in the rolling foothills south of the coastal plain from the Babbage River in the east to the Jago River in Alaska. King Point is on the fringe of the calving area and is of very little importance to the herd in this regard (Government of Yukon, 1983b, 1983c, 1983d). Following calving, the cows and calves drift westward and northward in nursery bands, moving toward the coast as it becomes snow-free. The non-calving component merges with the cows and calves in late June or early July, by which time most caribou have left Yukon and the herd is moving toward the Canning River - Barter Island area.

In early July, the herd forms into large aggregations and begins an eastward migration toward a "staging area" in the Bonnet Lake-Blow River headwaters area of north Yukon, from which it disperses in smaller groups, largely towards Alaska. A few groups move northward to the coast in most years. For example, about 2 000 caribou moved to the Coal Mine Lake area and the mouth of the Blow River in 1971 and a similar herd was located near Shingle Point in 1972 (Dome et al., 1982).

The herd begins to congregate again at the north end of the Old Crow Flats in late August and early September prior to the initiation of fall migration which follows both the Old Crow and Richardson routes. Few caribou are typically located on the coastal plain during late summer and little activity occurs there during fall migration. However, occasionally caribou have been reported to remain at or return to the coastal plain in the fall. For example, about 4 000 caribou were located in the uplands bordering the Mackenzie Delta between the Big Fish River and Shingle Point in November 1973, and virtually the entire herd overwintered in the northern Richardson Mountains in the NWT/Yukon border area in 1984/85 (Fred McFarland, Northern Environment Directorate, DIAND, personal communication). Caribou do not overwinter on the coastal plain because of the extreme cold and lack of forage.

3.2.2.2 Moose

Moose distribution on the Yukon coastal plain is largely limited to rivers and stream valleys and lake shores (figure 18). Vegetation along the river valleys generally consists of various willow species, alder and in more favourable areas small aspen and birch trees. These are preferred browse species for moose and also offer some cover. Sedges are available along the shores, lakes and ponds, and the water itself offers refuge from biting insects.

Densities of moose are low along the coastal plain and not more than a hundred moose are estimated to use the entire north Yukon watershed. The King Point area offers suitable habitat for moose, particularly along the

Deep Creek and Babbage River valleys and in and around the numerous tundra ponds and lakes (Government of Yukon, 1983b, 1983c, 1983d).

3.2.2.3 Muskoxen

Muskoxen were eliminated throughout northern Alaska and adjacent Yukon by hunting associated with whaling around the turn of the century. In 1969-70, muskoxen were transplanted from Barter Island and Kavik Camp into the Alaska Arctic Wildlife Range and some animals have since migrated into Yukon. The largest group observed, numbering six animals, was found near Spring River in 1973. The group moved further east, and four were shot by natives near King Point (Wiken et al., 1981).

Since that time, other small groups have been seen on the coastal plain and further south, although most seem to be using the tussock tundra of the coastal plain (Wiken et al., 1981). Whether a viable population will be established remains to be seen.

3.2.2.4 Wolves

It is estimated that there are 200 to 400 wolves in the north Yukon between the Peel River and the Beaufort Sea coast (Government of Yukon, 1983b, 1983c, 1983d). Most observations of wolves have been made incidentally, in conjunction with surveys of other wildlife, particularly caribou. Several active dens have been located on the coastal plain, including one in the King Point area, but systematic field studies of wolves in the north Yukon have not been carried out, and little is known about wolf distribution, numbers and habitat use.

3.2.2.5 Arctic Fox

Arctic foxes are relatively common residents of the Yukon coastal plain and are the most abundant furbearer.

The best sites for fox dens, as for wolf and grizzly, are gravel banks with a southern exposure and the majority of dens are located on or near lake shores and river and stream banks (figure 17). The most suitable area for denning habitat (Class 1) in the north Yukon is the coastal plain between the Malcolm and Babbage rivers which has a reported density of one fox den per 44 km^2 (Government of Yukon, 1983b, 1983c, 1983d). The coastal plain between the Babbage and the Blow rivers, including King Point, is lower and wetter and therefore not as suitable for denning and is considered Class 2 habitat. One den per 495 km^2 has been estimated (Dome et al., 1982).

Detailed studies on red and coloured fox use of the King Point area are not available.

3.2.2.6 Grizzly Bears

Grizzlies are the most common and widespread of the bears found on the coastal plain. However, comparatively little is known about grizzlies in the north Yukon.

The north Yukon coastal plain, with the exception of the northwest corner, has been classified as Class 1 grizzly habitat in that the area has no obvious factors which limit grizzly bears and could support densities up to one bear per 40 km^2 (Nolan et al., 1973; figure 18). The maximum carrying capacity for the entire north Yukon is about 700 animals (Wiken et al., 1981).

Grizzlies range widely, and during summer considerable use is made of the coastal plains, particularly the riparian vegetation along rivers, streams and lakeshores. Grizzlies also make heavy use of the coastline, probably in search of fish or marine mammal carrion washed ashore. Heaviest use of the coastal plain is made during the periods when caribou calves are present and when the bears are feeding on roots and emerging forbs on alluvial flats. Later in the season the mountainous region south of the coastal plains becomes more important because of the berry crops, and it is here where most dens are located. However, old dens have been reported in the Deep Creek valley south of King Point (Slaney, 1975).

3.2.2.7 Other Mammals

A number of other mammals frequent the coastal plain in varying numbers. Furbearers occasionally seen include wolverine, lynx, least weasel, ermine and marten. Other mammals recorded on the coastal plain include brown and collared lemmings, snowshoe hares, masked shrews, arctic shrews, arctic ground squirrels, northern red-backed voles and tundra voles (Kiewit, 1983).

3.2.3 Fish

There are two major drainage systems in the King Point area: the large Babbage River system to the west, and the smaller Deep Creek system to the south. Few studies have been completed on freshwater fish in the northern Yukon, but sampling programs have been carried out and some information is available. Figure 26 shows the location of water bodies which have been sampled. Table 11 provides a summary of fish species reported for these locations.

3.2.3.1 The Babbage River Drainage System

The Babbage is one of the largest river systems in the north Yukon and drains an extensive area between the British Mountains and Phillips Bay. It is particularly important for its spawning population of anadromous arctic char in the river below the Babbage Falls. A population of dwarf resident char occurs above the falls (LGL, 1982).

The Babbage system is also used by arctic grayling for spawning, rearing, feeding and overwintering (LGL, 1982). Arctic grayling are probably the most common fish in the system, as elsewhere in the north Yukon, but little is known about their migratory patterns and productivity.

Broad whitefish use the Babbage for spawning and rearing but overwinter elsewhere. Fry of several whitefish species have been recorded in the

lower reaches of the Babbage (Dome et al., 1982) and least cisco overwinter in at least one lake in the system (Slaney, 1975).

3.2.3.2 The Deep Creek Drainage System

Deep Creek is somewhat unusual in that rather than draining south to north it runs along the coastline plain parallel to the coast and drains to the Beaufort at two points: via the Babbage near Phillips Bay and via the Walking River near Shingle point (Peat Lake). Deep Creek is considerably smaller than the Babbage with poorer spawning areas and no overwintering capacity - it freezes to the bottom each winter (Slaney, 1975).

Arctic grayling use Deep Creek for spawning and rearing and overwinter in at least one associated lake and fry of whitefish species have been captured in the river (Dome et al., 1982). Humpback whitefish, broad whitefish, round whitefish, ninespine stickleback and slimy sculpin have also been recorded and northern pike have been recorded in a nearby lake (Bryan, 1973) and in Deep Creek (Bryan et al., 1973).

3.2.3.3 Lakes and Ponds

The tundra ponds in the King Point area are shallow and freeze to the bottom in winter but some of the deeper lakes are capable of supporting overwintering fish populations. Slaney (1975) sampled twelve lakes along the coastal plain east of the Babbage River; six of these are near King Point (figure 26) and of these six, four yielded fish when sampled by gill net. Arctic grayling, broad whitefish, northern pike, humpback whitefish, lake trout, least cisco and ninespine stickleback were taken at various locations (Table 11).

3.2.4 Birds

Bird use of the King Point area falls into two general categories: "en route" use during migration and "summer resident" use for nesting, feeding and moulting purposes. The Yukon North Slope is not heavily used during spring migration (Dickson, 1985). However, about a hundred bird species numbering in the millions frequent the north Yukon and adjacent offshore during the brief summer season.

The major migration routes used by these birds in the spring are, in order of relative use made of the King Point area:

- north down the Mackenzie Valley flyway and then westward along the Yukon coast toward Alaska. Birds using this route begin arriving in late May and early June and include snow, Canada and white-fronted geese, tundra swans, pintails and shorebirds. They are not commonly found in offshore leads but rest and feed on the tundra, open coastal lagoons and open river mouths (particularly the Babbage delta-Phillips Bay area);

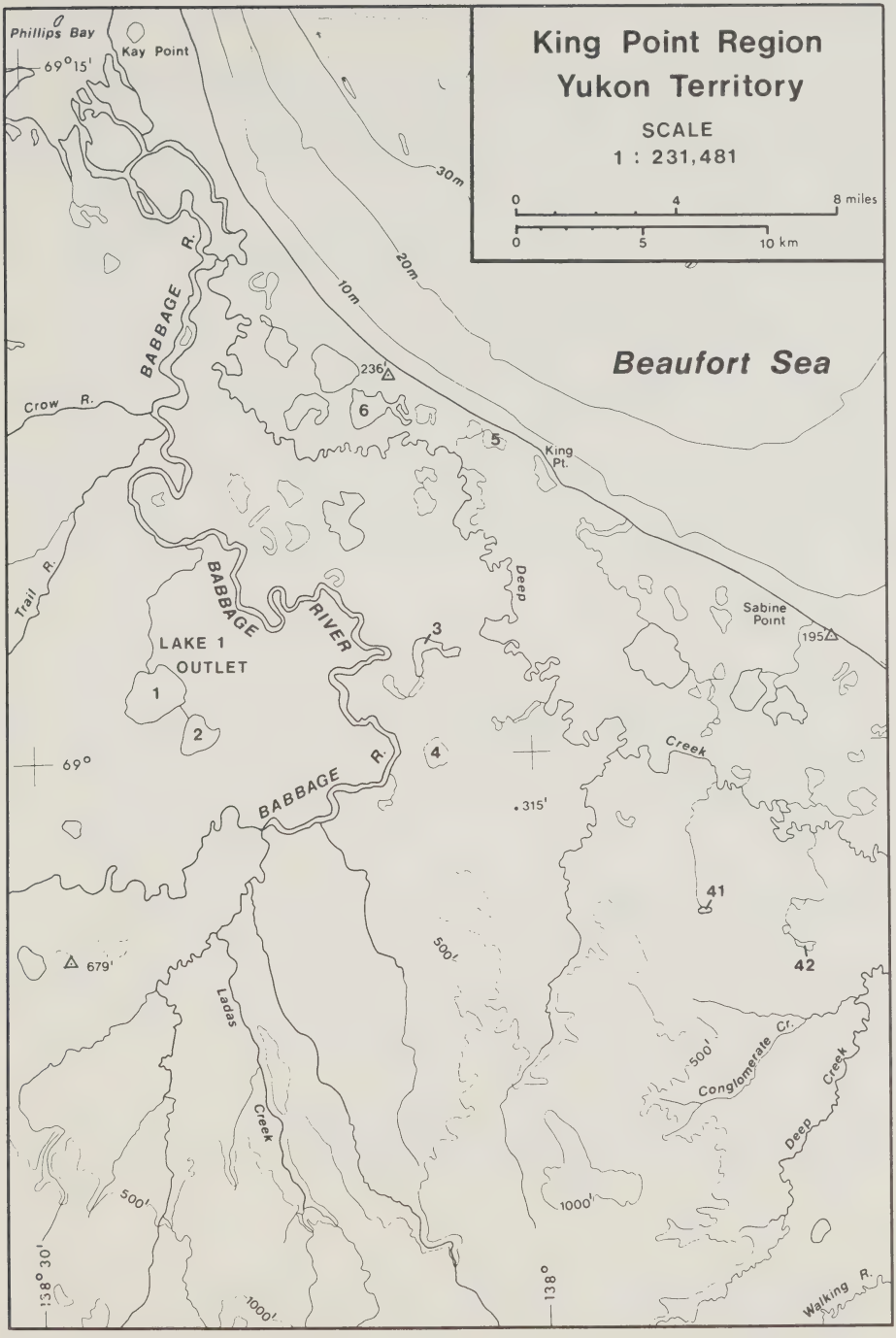


Figure 26

Lakes and Streams Sampled for Fish in the Area of King Point, Yukon Territory

Table 11

ANADROMOUS AND FRESHWATER FISH REPORTED IN THE AREA OF KING POINT, YUKON

Location	arctic grayling	arctic char	lake trout	least cisco	round whitefish	broad whitefish	humpback whitefish	northern pike	slimy sculpin	ninespine sickleback	"other whitefish species"
Lake 1	(b)(c)			(c)		(b)(c)					
2											
3								(b)			
4											
5				(b)							
6			(b)			(b)	(b)	(b)		(b)	
41	(c)										
42											
Deep Creek	(a)(c)(d)	(c)			(c)	(c)(d)	(c)(d)		(c)	(c)(d)	
Babbage River	(a)(b)(c) (d)	(a)(b) (c)(d)			(c)				(c)	(c)	(c)
Lake 1 Outlet	(b)										

(a) Bryan, 1973
(b) Slaney, 1975
(c) Dome et al, 1982
(d) LGL, 1982

- a northeastward route over the Brooks Range and the British Mountains and across the Beaufort to the Banks Island area. Some black brant, oldsquaw, eider and arctic and yellow-billed loon probably follow this route, the least used of the three major flyways; and

- an easterly offshore route from Point Barrow and the Pacific. Early arrivals using this route in late April to early May follow the offshore lead system (figure 25) also used by beluga and bowhead whales. Loon, brant, oldsquaw, eider, glaucous gull, phalarope, jaeger and murre heading for the eastern Beaufort Sea, Amundsen Gulf and western arctic islands nesting grounds use this route and rest and feed in available open water. Migrants arriving later in spring will take advantage of breakup and follow open-water routes nearer the coast (Richardson and Johnson, 1981).

Fall migration routes are usually the same with the exception of the offshore route, but in the reverse direction. Birds using the offshore route in fall tend to stay nearer the coastline, as opposed to the spring when the offshore lead system provides large expanses of open water.

3.2.4.1 Waterfowl

Lesser Snow Goose

Most of the approximately 430,000 lesser snow geese using the Beaufort region nest on Banks Island and in the Anderson River area, and many use the Yukon coastal plain and adjacent foothills for fall staging prior to the migration south. Figure 19 illustrates the distribution of staging areas used in recent years. Concentration areas for staging snow geese vary from year to year, and therefore any area of the coastal plain may be used over the years.

Peak use occurs between late August and mid-September, and depending on weather conditions, staging snow geese may use sites as far west as the Canning River in Alaska or, if early freeze-up and snowfall prevent staging on the North Slope, the geese may be confined to sites in the Mackenzie delta or the Anderson River area. Areas of the Yukon North Slope that have received heavy use over time include Deep Creek, the Blow River region, the upper Conglomerate Creek region and the central Babbage River region (Koski, 1975, 1977; LGL, 1982; Dickson, 1985).

In normal years, snow geese remain at the staging areas for two to three weeks, feeding and accumulating fat reserves. The birds tend to remain on the North Slope until the first heavy snowstorm, usually mid to late September.

White-fronted Goose

The white-fronted goose is the most abundant goose species nesting along the Alaskan North Slope, but relatively few breed on the Yukon coastal plain. A small percentage of the North American population of 200,000 uses the Yukon North Slope migration corridor en route to Alaskan nesting

grounds from the Mackenzie flyway in early spring (Richardson and Johnson, 1981).

Fall migration from the Alaskan coastal plain is gradual, beginning as early as mid-August and continuing until late September. The major staging area is on the Mackenzie delta but large concentrations have been observed in some years on the Yukon North Slope, principally the Blow River delta, the Tent Island area and Phillips Bay (figure 19). Up to 18,000 birds have been recorded staging on the Yukon North Slope (Koski, 1977).

Black Brant

Spring migration of black brant into the northeast Chukchi and Beaufort Sea begins during late May via the overland coastal flyways. Although relatively few black brant use the Yukon North Slope for breeding, Richardson and Johnson (1981) report that brant concentrate along the Yukon coast in spring en route to nesting sites in Alaska.

After hatching in early July, broods in coastal areas move to tidal flats where they feed on sedges and marine invertebrates and adults moult.

Fall migration is almost entirely confined to the coastal route. Migration begins during mid to late August and includes frequent and brief stops at lagoons and deltas for feed and rest. The most important Yukon sites include Tent Island, the Blow River delta and particularly Phillips Bay. Over 12,000 black brant were counted at the latter site on September 8-9, 1980 (Barry et al, 1981) and Dickson (1985) recommended that Phillips Bay be considered a key area for brant during fall migration (figure 19). By early September most brant have left the Beaufort Sea region.

Canada Goose

Canada geese, much less common in the northern Yukon than other geese, nest inland but move to traditional coastal areas, including the Herschel Island area, for moulting. Fall migration occurs primarily overland and most Canada geese have left the Beaufort region by early September. Canada geese can be considered an uncommon user of the King Point region (Dickson, 1985).

Tundra Swan

Up to 200 pairs of tundra swans nest on the Babbage River delta and on nearby lakes and ponds (Government of Yukon, 1983b, 1983c). In addition, the approximately 800 swans that nest on the Alaskan North Slope migrate westward along the Yukon North Slope from the Mackenzie Delta during late May and early June.

Fall staging occurs in traditional areas, including Shoalwater Bay, Phillips Bay and the Tent Island area, and as fall progresses the swans move inland to the inner Mackenzie delta. Phillips Bay has the largest concentration of moulting swans on the Yukon coastal plain (figure 19). Swans from the Alaskan North Slope migrate along the Yukon coast as

freeze-up begins and appear to join the swans in the delta, leaving that area between mid-September and early October.

3.2.4.2 Ducks

Dabbling Ducks

The Beaufort Sea is at the northern extremity of the breeding range of dabbling ducks and relatively few are found along the Yukon North Slope in most years. The northern pintail is the most common species, followed by widgeon and green-winged teal and in lower numbers by mallard, gadwall, blue-winged teal and northern shoveler. Overall, density and species representation of nesting dabblers in the King Point area are typical for the North Slope and Mackenzie delta (Dickson, 1985).

Dabbling ducks arrive in the Beaufort via the Mackenzie flyway during mid-to-late May and are dispersed over the coastal tundra by late June (figure 20). Dickson (1985) identified Deep Creek as a major moulting area and the Blow River delta also provides important habitat. Dickson observed densities of moulting ducks in 1981 at Deep Creek that were six to twelve times higher than on the Mackenzie delta, but noted that the high numbers may have been a direct result of drought on the prairies that year.

Fall migration of dabbling ducks in the Beaufort region is underway by mid-August, and most dabblers have left the coastal plain by early September.

Diving Ducks

The Yukon North Slope is important to at least 17 diving duck species, of which the most common are oldsquaw, greater scaup, surf and white-winged scoter and king and common eider. Red-breasted and common merganser, steller's eider, black scoter, common and barrow's goldeneye, bufflehead and harlequin duck are also present but in lower numbers. As with dabblers, density and species representation of nesting diving ducks in the King Point area are typical for the North Slope and Mackenzie delta (Dickson, 1985).

Diving ducks usually arrive at North Slope nesting areas in late May to mid-June in large flocks, nesting as dispersed pairs in emerging vegetation along lakes and ponds and along the coast (figure 20). After incubation begins, the males gather in large flocks and may undertake long migrations to moulting areas along the Beaufort Sea coastline in early July. Workboat Passage is a particularly important moulting area while the King Point offshore, although it supports substantial numbers of moulting divers, is not a critical area (Dickson, 1985).

Fall migration takes place in large flocks from late August to mid-September. Weather is probably the main factor in determining timing and degree of use of the Yukon coast, as it is for snow geese. Most movement during fall migration is along the coast.

3.2.4.3 Loons

Arctic, red-throated and yellow-billed loons occur on the Yukon North Slope, although the latter is a rare visitant in the north Yukon and probably does not nest locally. The Arctic loon is the most common breeding loon on the Yukon coastal plain (by about 5:1) and arctic and red-throated loon densities in the King Point area are comparable to densities on the Alaskan coastal plain and the Mackenzie delta (Dickson, 1985).

Richardson and Johnson (1981) reported that loons usually use the offshore migration route in spring (early to mid-June) and fall (late August to late September), but that some may use the interior route over the British Mountains and the Brooks Range.

Red-throated loons nest on small, shallow tundra ponds while arctic loons tend to use the larger lakes. Because the shallow ponds freeze to the bottom during winter and therefore contain no fish, red-throated loons feed in nearby large lakes, rivers and in marine waters. Proximity to the coastal zone is therefore important to this species. Arctic loons usually feed where they are nesting.

3.2.4.4 Shorebirds

Shorebirds arrive at the Beaufort Sea from mid May to early June via all three major flyways, although the Mackenzie route is probably most heavily used (Richardson and Johnson, 1981), and disperse rapidly to tundra nesting sites where they comprise up to 70% of all birds present (Myers et al., 1980). At least 11 shorebird species have been recorded in the King Point region. The most abundant species are red-necked phalarope, lesser golden plover, semipalmated plover, whimbrel and stilt sandpiper.

Although shorebirds nest throughout the King Point region, wet marshy lowland tundra is preferred by all species except the lesser golden plover, which is more abundant in drier upland habitat (Dickson, 1985). Wet sedge and tussocky patterned ground (ice-wedge polygons) wetland habitat types are most heavily used, particularly by red-necked phalaropes, pectoral sandpipers, whimbrel and semipalmated and still sandpipers. Wetlands in the vicinity of King Point may be regionally important for whimbrel and stilt sandpiper (Dickson, 1985).

Prior to fall migration, flocks of shorebirds frequently stage at coastal sites including the south shore of Herschel Island, along freshwater shorelines or on open upland habitats. The Babbage River delta is an important staging area for some species of shorebirds.

Fall migration is protracted, partly because different age and sex classes leave the breeding areas at different times depending on the species, and can occur from July to early September. Adults tend to depart in July, while juveniles leave in August and by early September few shorebirds remain on the coastal plain.

3.2.4.5 Passerines

At least 16 species of passerines have been observed in the King Point region, and the most common of these are lapland longspur, savannah sparrow, redpoll and American tree sparrow.

Seed-eating passerines are the first to arrive in the coastal Beaufort in spring. Snow buntings appear on the coastal plain during mid-April and lapland longspurs by early May; insectivorous species do not usually appear until early June.

Although the coastal plain around King Point does not offer exceptional habitat for passerines, the upper Babbage River may be of local importance to several species which are otherwise rare or very rare on the Yukon North Slope (Dickson, 1985).

Southward migration probably begins in August, but many species may remain on the coastal plain until mid-to-late September. Migration in and out of the coastal plain is overland via Alaska or the Mackenzie Valley.

3.2.4.6 Raptors

In the northern Yukon, gyrfalcon and golden eagle are important raptors; northern harrier, rough-legged hawk, short-eared owl and, less frequently, marsh hawk, snowy owl, merlin, kestrel and bald eagle are also present.

The King Point area is not known to be particularly important raptor habitat; golden eagle feed on caribou carrion when the animals are moving through the area, owls probably nest in the area and other raptors hunt throughout the coastal plain including King Point. The Babbage and Trail river valleys do offer excellent habitat for cliff nesting raptors; the valleys may be particularly important for gyrfalcons (Dickson, 1985).

It should be noted that the peregrine falcon (tundrius subspecies) has probably been extirpated from the North Slope, as none of the known nesting sites have been occupied since 1979 (Government of the Yukon Territory, 1983). The Yukon Wildlife Branch has initiated attempts to breed this falcon in captivity with the intention to reestablish a wild population and it is therefore important that the nest sites receive the same degree of protection that is given to occupied eyries.

3.2.4.7 Other Birds

Grouse

Willow and rock ptarmigan are widespread in the north Yukon and are resident year-round. Flocks form in late summer, remain intact until April and may contain 400 or more individuals. Winter flocks of willow ptarmigan occur primarily in riparian shrub habitat and feed on willow buds and twigs. Dwarf birch buds and catkins are the most important winter feed for rock ptarmigan.

Jaegers

Three species of jaegers nest in areas adjacent to the Beaufort coast: pomarine jaeger, parasitic jaeger and long-tailed jaeger. Parasitic and long-tailed jaegers nest on the North Slope while the pomarine jaeger is a rare breeder but a common coastal migrant. The King Point area offers typical breeding habitat.

Jaegers arrive in Yukon by early June via the north coast of Alaska or via overland routes along the eastern Brooks Range.

The long-tailed jaeger was the most abundant jaeger observed during 1981, and the parasitic jaeger was also common (Dickson, 1985). Both are considered common summer residents on the coastal plain.

Fall migration of successfully nesting birds begins shortly after the young fledge in August and most adults have left the area in small, widely dispersed groups by mid-August.

Gulls and Terns

Glaucous gulls and arctic terns are the most common gull and tern species on the Yukon coast. They mainly nest on barrier islands, offshore spits, barrier beaches and river deltas along the Yukon coast.

Glaucous gulls migrate primarily along the coastal route and arrive in the King Point area by mid-May, with peak migration along the Yukon coast during late May and the first three weeks of June. A breeding colony has been recorded at Phillips Bay (Dickson, 1985). This is one of only five colonies on the Yukon coast although pairs have been observed nesting on islets in wetlands near King Point. It has been suggested that the latter may be more successful nesters than gulls in colonies and may therefore be an important component for recruitment of young gulls (Dickson, 1985).

Nesting begins in early June, eggs hatch by mid-July and by late August and early September the young have fledged. The fall migration follows a nearshore coastal route and most gulls probably leave the region after mid-September.

Arctic terns are widely distributed and common throughout the Yukon coastal plain. They nest on barrier islands along the Yukon coast and on marshes or by lakes. Phillips Bay may be an important nesting area for arctic terns.

Peak fall migration for arctic terns occurs in mid-August and by early September all terns have probably left the region.

3.2.4.8 Conclusion

Densities of nesting water-oriented birds including waterfowl, jaegers, gulls, terns, shorebirds and loons have been observed to be much higher within ten kilometres of the coast than further inland (Dickson, 1985), although the wetlands which provide favoured nesting sites are fairly

evenly distributed across the coastal plain. In addition, Dickson identified several key areas for certain bird species in the King Point region:

- Although the entire region is important to staging lesser snow geese in the fall, the Deep Creek valley and the Babbage River have been identified as major staging areas.

- Phillips Bay and the Babbage delta support high densities of nesting glaucous gulls, tundra swans, shorebirds, terns, moulting, dabbling and diving ducks, and staging brant and white-fronted geese. Shorebirds feed on the delta mud flats throughout the summer. In 1981 bird densities along the lower Babbage River and the Phillips Bay shoreline were nearly double densities observed elsewhere in the King Point region.

- The Babbage and Trail river valleys provide excellent cliff nesting habitat for some raptors, particularly gyrfalcons, and the upper Babbage River valley is locally important to several species of passerines.

- Deep Creek is likely preferred habitat for breeding and moulting dabbling ducks.

- King Point lagoon may be locally important to oldsquaws for moulting.

- Wetlands near King Point may be regionally important to whimbrel and stilt sandpiper.

Disturbance associated with industrial development at King Point (loss or degradation of habitat, direct mortality, noise and human activities) would be widespread and could seriously disrupt feeding, nesting, rearing and staging activities of most species using the area. Of particular concern are disturbance to fall staging lesser snow geese, increased access by hunters and tourists, disturbance of birds using Phillips Bay and the Babbage delta, loss of wetland habitat and oil or chemical spills. Development at King Point could have a major impact on lesser snow geese in particular (Dickson, 1985). These and other potential impacts and suggested mitigative measures are discussed in Chapter Six.

APPENDIX 3

A Review of Federal and Territorial Legislation Relevant to Conservation Planning in the North Yukon

1.0 Legislation

The intent of this section is to identify the advantages and disadvantages of applying particular pieces of federal and territorial legislation, first and foremost, to protect formally and in perpetuity the area of the north Yukon outside the North Yukon National Park and secondarily, to permit limited industrial development to proceed within conservation lands.

1.1 Federal Legislation

1.1.1 National Parks Act

Administration: Parks Canada (Department of the Environment)

Management Objective: the protection and preservation in perpetuity of unique and representative natural and cultural areas of Canada

Advantages:

- Because the National Parks Act has been in force for over 50 years, Parks Canada has acquired considerable experience and has the policy base to assist in long-range planning.

- Land cannot be removed from national park without Parliamentary approval but land can be added through Order in Council.

- Strong protection is provided against negative environmental impacts resulting from developments on park land.

- Inter-agency co-operation in the management of wildlife in national parks is permitted under the Act.

- Parks Canada has gained considerable experience in involving native people in the management of national parks and in permitting native harvesting of wildlife in certain parks (e.g. Wood Buffalo National Park and Kluane, Nahanni and Auyuittuq National Park Reserves). Parks Canada supports public participation in national park planning.

- Parks Canada has adopted a zoning system as its basic land management tool. The five zones range from class 1 (preservation of special areas susceptible to use) to class v (intensive use areas required for development or park management and visitor support facilities).

Disadvantages:

- The general purpose of national parks, as stated in the Act, is to provide for the benefit, education and enjoyment of the public. This recreational focus may conflict with wilderness values and resource conservation goals.

- Establishment of a national park is an extremely lengthy process and often involves a considerable number of political trade-offs.

- Regulations developed pursuant to the Act do not require Parliamentary approval. Instead, they are set according to prevailing Parks Canada policy and approved through Order in Council. Policies addressing major issues may be developed by the bureaucracy with little public input.

- Under the Act, the Governor in Council may permit certain extractive, commercial and recreational uses within a park. Included are rights-of-way for highways, telephone, telegraph or electrical transmission lines and oil or gas pipelines, as well as supporting infrastructure like electrical substations and tanks, reservoirs and loading facilities for oil and gas pipeline. However, establishment of a multi-user, multi-purpose facility at King Point and nearby quarries would not be consistent with general park policy and would certainly run counter to wilderness area philosophy.

- The National Parks Act is ill-suited to the protection of a migratory resource which enters and leaves park lands.

- Parks Canada is part of the Department of Environment, a relatively weak federal department. DIAND is reluctant to transfer control of land to another department, particularly if tight controls are to be placed on development.

- Development interests would strongly resist the establishment of a national park east of the Babbage River because such a development would severely restrict resource development in the north Yukon and reduce access to the Yukon coast.

Summary:

The National Parks Act is the strongest piece of legislation available in Canada to set aside in perpetuity large areas of wilderness. The sections of the Act which allow the Governor in Council to permit oil and gas pipeline corridors and loading facilities and highway rights-of-way could apply to a single purpose King Point harbour and a Dempster link, but a multi-user, large scale facility would probably not be permitted.

YTG would also oppose any additional "federal land-grabs" in the north Yukon. In short, although the establishment of a national park encompassing the entire north Yukon (including or excluding King Point) would be the best avenue for protection of the wilderness values found there, and could accommodate certain limited industrial development, political difficulties likely rule out this option.

1.1.2 Canada Wildlife Act

Administration: Canadian Wildlife Service (Department of Environment)

Management Objective: management and maintenance of natural areas critical to migratory species and the protection of related wildlife

Advantages:

- The designation of wildlife areas is not subject to Parliamentary consideration or approval but can be assigned to the Minister of the Environment by the Governor in Council, as has been done in the case of Polar Bear Pass. The Minister has powers and functions related to the conservation, research and interpretation of wildlife and can be assigned administration, management and control of public lands for these purposes, in co-operation with other agencies.

- The Minister of the Environment has wide discretionary powers to allow any activity within a wildlife area if it is believed by the Minister that the activity will not interfere with wildlife conservation.

- The application of the Act extends beyond migratory birds and is well suited to the protection of other migratory species, including the Porcupine caribou herd, through co-operative management agreements with individuals and groups, including YTG and native groups. Unlike the provisions in the National Parks Act, the Crown is not required to own lands in order for CWS to pursue its mandate;

- The Canadian Wildlife Service is an experienced and widely respected wildlife protection agency.

Disadvantages:

- Wildlife areas can be dissolved or boundaries changed through Order in Council.

- There is no specific reference in the Act or the Wildlife Area Regulations to native uses, although the regulations contain a general prohibition on hunting and fishing.

- Public involvement in the establishment or management of wildlife areas is not specifically addressed, although provision is clearly made for co-operative management agreements between CWS and public or private organizations. A precedent for federal-territorial

co-operation now exists in the establishment of a Canada Wildlife Area at Polar Bear Pass.

- CWS has had little experience in managing large parcels of land, particularly in the north.

- Neither DIAND nor YTG are likely to fully support turning over control of large areas of Yukon to the Department of the Environment, despite the favourable reputation of CWS.

Summary:

Establishment of a National Wildlife Area in the balance of the north Yukon not included in a National Park is a very attractive alternative option. Properly controlled development at King Point could be permitted, as could the construction of a transportation and utility corridor to the Dempster Highway. Other resource developments would be permitted only if they did not interfere with wildlife conservation and a joint management board (perhaps the North Slope Wildlife Management Council required by the Inuvialuit Final Agreement) with representation from CWS, YTG, COPE, CYI and others could be established to administer the area.

Nevertheless, despite the advantages, one can expect that YTG would oppose the establishment of a National Wildlife Area in the north Yukon because CWS would be the central authority and the Minister of the Environment would have the final decision on any issue. DIAND would also be reluctant to surrender control to DOE.

1.1.3 Migratory Birds Convention Act

Administration: Canadian Wildlife Service (Department of Environment)

Management Objective: protection of migratory birds and their habitat

Advantages:

- Migratory bird sanctuaries can be established without Parliamentary consent. These sanctuaries are placed under the control of the Minister of the Environment insofar as protection of migratory birds and their habitat is concerned. Regulations to control hunting of migratory birds are made by the Governor in Council.

- Certain industrial activities are permitted within bird sanctuaries. For example, exploratory drilling has been permitted within the Kendall Island Bird Sanctuary during winter.

Disadvantages:

- The Act applies only to areas inhabited by migratory birds, and protects only migratory birds and only those species identified in the Act. Further, the degree of protection offered to bird habitat is unclear.

- The Act does not empower the Minister of the Environment to purchase or acquire land for sanctuaries.

- There is no mechanism for public input into the planning and management of bird sanctuaries.

- Sanctuaries can be dissolved or altered through Order in Council.

Summary:

Clearly, this legislation would be of little use in protecting large areas and all forms of wildlife in the north Yukon.

1.1.4 Territorial Lands Act

Administration: Department of Indian Affairs and Northern Development

Management Objective: provides for the administration of lands in Yukon and NWT under federal control

Advantages:

- Under the Act the Governor in Council can establish land management zones and develop regulations to minimize the adverse environmental impacts which could result from the development of non-renewable resources.

- The Governor in Council can withdraw lands from disposition under the Act as a temporary measure pending decisions on the future use of the land. (In July 1978 the area of the Yukon north of the Porcupine and Bell rivers was withdrawn pending the settlement of land claims and for a national park and other conservation purposes. The area of the north Yukon outside the North Yukon National Park remains withdrawn at present.)

Disadvantages:

- The land use regulations are reactive rather than proactive and are designed primarily to facilitate development while preventing unnecessary habitat damage.

- Withdrawals made under the Act do not affect existing rights and are intended as interim measures only. Further, a withdrawal order can be amended or cancelled through Order in Council.

- Although the Act covers land management, wildlife management is the responsibility of the territorial governments.

- The Act does not apply to placer or hardrock mining in Yukon.

Summary:

Use of the Territorial Lands Act to formally and indefinitely protect an area of the north Yukon would be inappropriate.

1.1.5 Northern Inland Waters Act

Administration: Department of Indian Affairs and Northern Development

Management Objective: conservation, development and utilization of the water resources of the Yukon and NWT

Advantages:

- The Governor in Council is authorized by the Act to withdraw from disposition under the Territorial Lands Act or other appropriate legislation any lands required for the protection of any water resource. Lands set aside in this manner would be open to hunting, fishing and trapping activities.

- The Act allows the Minister of DIAND to enter into co-operative agreements with territorial governments to develop comprehensive water resource management plans.

- Public hearings are held by the Water Board in connection with every application for a licence, licence renewal or licence amendment. Environmental impact statements may be required and the Board may attach terms and conditions to ensure proper use of the resource.

- The Act specifically applies to all mining activities, including placer mining.

Disadvantages:

- There is considerable uncertainty regarding the role of the Yukon Water Board in administering the Act. Amendments to the Act have been prepared by DIAND but have not been dealt with by Parliament.

- A licence is not required when the proposed period of use is less than 270 days or the quantity of water to be used is less than 50,000 gallons per day. "River engineering" projects, including pipeline crossings, are technically exempt under the regulations.

- The Governor in Council can eliminate or alter the boundaries of reserves established under the Act.

Summary:

Although the Northern INland Waters Act is a useful conservation tool it is too limited in scope to fully protect the northeast Yukon.

1.1.6 Fisheries Act

Administration: Department of Fisheries and Oceans

Management Objective: protection and conservation of fish resources and fish habitat

Advantages:

The Act specifically prohibits the harmful alteration. disruption or destruction of fish habitat and contains provisions governing use and conservation of "fish", including marine mammals.

Disadvantages:

The Act is limited to protection and conservation of fish and fish habitat and its legal effectiveness is questionable.

Summary:

The Fisheries Act is important in the protection of fish and marine mammals and their habitat, but would be of little assistance in protecting the northeast Yukon generally.

1.1.7 Western Arctic (Inuvialuit) Claims Settlement Act

The Western Arctic (Inuvialuit) Claims Settlement Act puts into legal effect the provisions of the Inuvialuit Final Agreement, signed in Tuktoyaktuk on June 5, 1984. The provisions of the Agreement set the context for development on the Yukon North Slope, and indirectly for the entire north Yukon, and are here discussed in detail in Chapter IV.

1.2 Territorial Legislation

1.2.1 Yukon Wildlife Ordinance

Administration: Wildlife Branch, Department of Renewable Resources, Yukon Territorial Government

Management Objective: management, harvesting and protection of non-migratory birds and mammals in Yukon

Advantages:

- Protected habitat areas and game sanctuaries can be established under the Ordinance.

- The Ordinance is administered by the Department of Renewable Resources, the most conservation-oriented agency within the YTG. Expertise in the Branch is recognized and respected within the YTG and by federal agencies.

- Non-renewable resource development activities can be allowed in both protected habitat areas and game sanctuaries and are regulated by the Territorial Lands Act and Land Use Regulations administered by DIAND.

Disadvantages:

- The Wildlife Branch has no control over the land in game sanctuaries (e.g. McArthur Game Sanctuary) and game preserves (e.g. Peel River Preserve), as the land ownership rests with DIAND. In fact, the YTG does not own land on which large and rational habitat reserves could be established. Wildlife management by the YTG is therefore seriously restricted.

- The Yukon Wildlife Ordinance which replaced the Yukon Game Ordinance does not refer to game preserves. Existing preserves may therefore be in some jeopardy and creation of new preserves is unlikely. A provision in the Ordinance refers to establishment of protected habitat areas wherein destruction or damage to habitat is prohibited, but the areas envisaged are likely quite small.

- There is no provision for public consultation in the establishment of sanctuaries or protected habitat areas.

- According to the Ordinance no one, including natives, may hunt in game sanctuaries. However, this provision appears to be in contravention of the Yukon Act which prohibits the Governor in Council from making ordinances which restrict the right of native people to hunt non-endangered game or unoccupied Crown Lands.

Summary:

The Yukon Wildlife Ordinance lacks sufficient strength to fully protect wilderness under the current circumstances. Even if a land transfer to Yukon was to occur for the purpose of establishing a protected habitat zone or game sanctuary, the Ordinance would not provide the protection in perpetuity required for the area of the north Yukon not within the national park.

1.2.2 Area Development Ordinance

Administration: Yukon Territorial Government

Management Objective: designation of "development areas" and regulation of the administration and development of such areas

Advantages:

Under the Ordinance any development area can be zoned for a variety of purposes, including "public and other purposes". Wildlife protection zones might be included in the latter.

Disadvantages:

- The Ordinance applies only to Commissioner's lands and there is currently only a very small amount of Commissioner's land in Yukon.

- Most of the powers in the Ordinance relate to municipal-type functions.

- There is no requirement for public participation in the zoning and management process.

Summary:

Although the Ordinance could have application along transportation corridors owned by the YTG, for example the Dempster Highway, there is little likelihood that the Ordinance could or would be used to properly control activities over broad expanses of wilderness.

1.2.3 Parks Ordinance

Administration: Yukon Territorial Government

Management Objective: establishment of a system of parks to protect unique natural and historic features and to provide for comprehensive outdoor recreational opportunities

Advantages:

- The Ordinance provides for the establishment of parks ranging in character from wilderness preserve to intensive recreational use.

- Land use zones covering a broad range, including primitive, natural, multiple use, recreation, historic and "only other such zone as may be necessary" may be designated within the park.

- The Commissioner may appoint committees or boards to perform such advisory functions as the Commissioner considers necessary or desirable in connection with the planning and administration of parks.

- Prior to any development in a park a master plan must be submitted to the Commissioner and must contain, among other things, a statement as to the purpose and classification of the park, an environmental impact statement and a strategy for development and management.

- Provision is made for restoration and repair of sites or resources damaged in contravention of the Ordinance and for compensation in cases where the damage is irreversible.

- The Commissioner may hold public meetings or hearings to discuss proposals to establish a park and may consult with representatives of persons who may be affected by the establishment of the park.

Disadvantages:

- The YTG must own the land intended for a park.

- In all cases, the Commissioner may permit non-renewable and renewable resource development within specified zones where such development is deemed to be in the best long term economic interest of Yukon. Although development in each park is to be generally consistent with the purpose for which the park was established, this caveat may provide too much temptation for a development-oriented government which could push development without adequate safeguards.

- Terms of reference and procedures for the advisory board or committee would be fixed by the Commissioner.

- Establishment of the advisory body, holding of public meetings and consultation with representatives of affected individuals is entirely discretionary.

Summary:

Overall, the Yukon Territory Parks Ordinance has the potential to set aside and protect large expanses of wilderness and at the same time permit development in specified zones. Indeed, the Inuvialuit Final Agreement calls for the establishment of Herschel Island as a wilderness territorial park, with the exclusion of Pauline Cove which would be designated a multiple use area. Protection equivalent to that of a National Historic Site would be provided for the Pauline Cove area while at the same time controlled industrial activity would be permitted. Presumably a similar scheme could be developed for the King Point area, with the establishment of a "primitive" zone which would form the bulk of the wilderness preserve and a multiple use zone which would incorporate quarry and shorebase facilities.

A major weakness lies in the proviso in the Ordinance which gives the Commissioner the power to permit development wherever and whenever it is seen to be in the best long term economic interest of Yukon. This could put at risk the long term security of the north Yukon wilderness outside the national park. Nevertheless, with proper safeguards, including a joint management board with representation from COPE, CYI, CWS, Parks Canada and the Wildlife Branch of YTG, a territorial park could serve the required purpose.

APPENDIX 4

Some Aspects of the Regulatory Framework for Development at King Point

The Inuvialuit Final Agreement sets in place the basic framework for environmental impact assessment and review for projects on the Yukon North Slope and is discussed in detail in Chapter Three. The Final Agreement also puts into context the draft Yukon - Canada land use planning agreement. If a development proposal is accepted as being consistent with existing regional land use plans and can meet the terms and conditions developed through the environmental screening and review process, a number of regulatory requirements would then come into play. Some of these are outlined here.

1. The current withdrawal under the Territorial Lands Act of the north Yukon from disposition would require amendment through Order in Council to permit any disposition of lands through leases, quarry permits or licences of occupation.

2. Land use permits would be required for site surveys and investigations, including geotechnical studies. (Land use permits do not constitute a disposition of land and therefore can be issued - and have been - without amendment to the withdrawal order.)

3. Quarry leases would be required to develop the quarry. Another Order in Council would be required under Section 4 of the Territorial Lands Act if the area to be leased under each permit exceeds 160 acres. Subject to the approval of the Minister of IAND quarry leases could then be granted for a term not exceeding ten years. The proposed new Pits and Quarrying Regulations would limit the term to five years.

4. A surface lease would be required for those quarry lands which would be developed over the initial five year period and could be amended as required to include additional lands.

5. Land use and quarry permits and a licence of occupation would be required for construction and operation of a haul road from the quarry site to the King Point harbour facility and for access roads at the harbour site. The licence of occupation could include some form of assurance on the part of DIAND that other users would be required to reach agreement with the quarry operator on such matters as cost sharing and priority uses. The licence of occupation could run for up to ten years.

6. Land use and quarry permits would be required for airstrip construction and a licence of occupation would be required for airstrip operation. Again, the licence could include commitments on the part of DIAND regarding agreements between the quarry operators and other users and could run for ten years.

7. Land use permits would be required for construction of harbour facilities including buildings, tank farms and stockpile areas at King Point and a surface lease would be required for the use of the land.

8. Water use licenses could be required for fresh water withdrawals for quarrying operations and domestic and other uses.

9. A surface lease under the Public Lands Grants Act would be required for breakwaters and the causeway (subsea land lease).

10. Approvals would be required under the Navigable Waters Protection Act for construction and operation of all offshore facilities, including docks, mooring basins and shipping channels. Transport Canada would probably also wish to apply the TERMPOL code to assess the environmental impacts and technical soundness of the harbour facility.

11. Ocean dumping permits will be required under the Ocean Dumping Control Act for disposal of dredge spoil and construction of the dock. Any dredged shipping channels would remain "common use lands" under the draft DIAND policy on seabed harbour lands administration.

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